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# UNIT 7

## Adding and Subtracting Fractions

» **Concept 1** : Adding and Subtracting Fractions with Unlike Denominators



### Fast Fact

Earth, our home planet, is called the "Blue Planet". About  $\frac{7}{10}$  of the Earth's surface, is covered with water, while  $\frac{3}{10}$  only of its surface is land.

## Pre-Study

- Equivalent Fractions
- Simplest Form of a Fraction

### Equivalent fractions

- Fractions that name the same amount are called **equivalent fractions**

**For Example** : Hany cut his pizza into 4 equal slices and his sister Noha cut her pizza into 8 equal slices. After eating some slices were left as shown.



What fraction of Hany pizza is left ?



What fraction of Noha pizza is left ?

### Answer

The left is 3 slices out of 4 equal slices

$$\frac{3}{4}$$

The left is 6 slices out of 8 equal slices

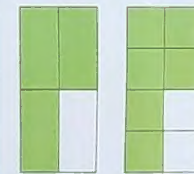
$$\frac{6}{8}$$

Since, Hany and Noha left the same amount of pizza, then the two fractions  $\frac{3}{4}$  and  $\frac{6}{8}$  represent the same amount, so,  $\frac{3}{4}$  and  $\frac{6}{8}$  are called equivalent fractions.

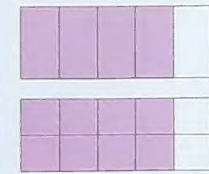
### Examples for equivalent fractions



$$\frac{1}{2} = \frac{5}{10}$$



$$\frac{3}{4} = \frac{6}{8}$$



$$\frac{4}{5} = \frac{8}{10}$$

## How to find equivalent fractions to a given one?

To get an equivalent fraction to a given one you can multiply or divide both of numerator and denominator by the same non-zero number.

### Example 1

Find four equivalent fractions to  $\frac{8}{24}$

**Solution**

$$\begin{array}{c} \times 2 \\ \frac{8}{24} = \frac{16}{48} \\ \times 2 \end{array} \quad \begin{array}{c} \div 8 \\ \frac{8}{24} = \frac{1}{3} \\ \div 8 \end{array} \quad \begin{array}{c} \times 3 \\ \frac{8}{24} = \frac{24}{72} \\ \times 3 \end{array} \quad \begin{array}{c} \div 4 \\ \frac{8}{24} = \frac{2}{6} \\ \div 4 \end{array}$$

• There are many other solutions.

**Check** your understanding

1. Complete.

$$\frac{2}{8} = \frac{6}{16} = \frac{\quad}{\quad} = \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

$$\frac{12}{18} = \frac{6}{6} = \frac{\quad}{\quad} = \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

### Simplest form of a fraction :

- Means the numerator and denominator are smallest numbers possible.
- That satisfied when the only common factor of the numerator and denominator is 1

### How can you simplify fraction to simplest form?

**Answer:** By dividing both of numerator and denominator by their greatest common factor (GCF)



### Example 2

Write each of the following fractions in the simplest form.

a.  $\frac{24}{32}$

b.  $\frac{14}{49}$

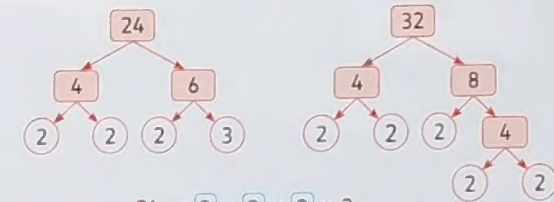
c.  $2\frac{8}{24}$

**Solution**

a.  $\frac{24}{32}$

$$\frac{24}{32} = \frac{3}{4}$$

• The simplest form of  $\frac{24}{32}$  is  $\frac{3}{4}$



$$\begin{array}{l} 24 = 2 \times 2 \times 2 \times 3 \\ 32 = 2 \times 2 \times 2 \times 2 \times 2 \\ \text{GCF} = 2 \times 2 \times 2 = 8 \end{array}$$

b.  $\frac{14}{49}$

$$\frac{14}{49} = \frac{2}{7}$$

• The simplest form of  $\frac{14}{49}$  is  $\frac{2}{7}$



$$\text{GCF} = 7$$

**Note**

You can use any method to find GCF

c.  $2\frac{8}{24}$

$$2\frac{8}{24} = 2\frac{1}{3}$$

• The simplest form of  $2\frac{8}{24}$  is  $2\frac{1}{3}$



$$\text{GCF} = 8$$

**Check** your understanding

Write each of the following fractions in the simplest form.

a.  $\frac{16}{20}$

b.  $\frac{18}{24}$

c.  $3\frac{6}{12}$

# Concept

# 1

# Adding and Subtracting Fractions with Unlike Denominators

## Lesson

## 1

## Finding Like Denominators Using the LCM

### Learn

You can change the two unlike denominator fractions into two like denominator fractions by replacing one of them or both by equivalent fractions of denominator equal the LCM of the two denominators.

For Example :

$$\frac{3}{8} \text{ and } \frac{5}{12}$$

are two unlike denominator fractions.

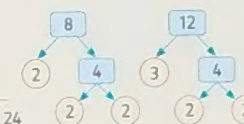
24 is the LCM of the two denominators.

Find LCM :

$$8 = 2 \times 2 \times 2$$

$$12 = 2 \times 2 \times 3$$

$$\text{LCM} = 2 \times 2 \times 2 \times 3 = 24$$



$$\frac{3}{8} = \frac{?}{24} \text{ and } \frac{5}{12} = \frac{?}{24}$$

Find equivalent fractions their denominators = LCM

$$\frac{9}{24} \text{ and } \frac{10}{24}$$

are two like denominator fractions.

### Did You Know?!

When people think of the word "lazy", sloths are often one of the first animals to come to mind where they sleep for up to  $\frac{5}{6}$  of a day, but the laziest animals are koalas where they can sleep up to  $\frac{3}{4}$  of a day!

$$\begin{aligned} &= 2 \times 2 \times 2 \\ 2 &= 2 \times 2 \quad \times 3 \\ \text{LCM} &= 2 \times 2 \times 2 \times 3 \\ &= 24 \end{aligned}$$

Lesson No.	Lesson Name	Learning Objectives
Lesson 1	Finding Like Denominators Using the LCM	<ul style="list-style-type: none"> <li>Students will generate pairs of fractions with like denominators.</li> <li>Students will explain how to find like denominators.</li> </ul>
Lessons 2 & 3	Estimating Sums and Differences of Fractions	<ul style="list-style-type: none"> <li>Students will use benchmark fractions and number sense of fractions to estimate mentally.</li> </ul>
	Using Models to Add and Subtract Fractions with Unlike Denominators	<ul style="list-style-type: none"> <li>Students will use models to represent addition and subtraction of fractions with unlike denominators.</li> </ul>
Lessons 4 & 5	Adding and Subtracting Fractions with Unlike Denominators, Part 1	<ul style="list-style-type: none"> <li>Students will add and subtract fractions with unlike denominators.</li> </ul>
	Adding and Subtracting Fractions with Unlike Denominators, Part 2	<ul style="list-style-type: none"> <li>Students will use benchmark fractions and number sense of fractions to assess the reasonableness of answers.</li> </ul>
Lesson 6	Solving Story Problems with Fractions	<ul style="list-style-type: none"> <li>Students will solve story problems involving addition and subtraction of fractions.</li> </ul>

### Example

Change each pair of unlike denominator fractions into like denominator fractions using LCM of the unlike denominator.

a.  $\frac{5}{6}, \frac{2}{3}$

b.  $\frac{3}{8}, \frac{5}{10}$

c.  $\frac{7}{10}, \frac{11}{15}$

### Solution

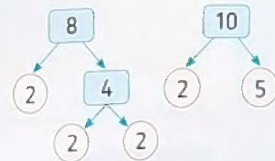
a.  $\frac{5}{6}, \frac{2}{3}$   
 $\frac{5}{6}, \frac{4}{6}$

$\frac{3}{6}, \frac{3}{6}$   
 $\frac{3}{6}, \frac{3}{6}$   
 $\text{LCM} = 3 \times 2 = 6$

b.  $\frac{3}{8}$  ,  $\frac{5}{10}$

$\downarrow$   $\downarrow$

$\frac{15}{40}$  ,  $\frac{20}{40}$



$$8 = 2 \times 2 \times 2$$

$$10 = 2 \times 5$$

$$\text{LCM} = 2 \times 2 \times 2 \times 5 = 40$$

c.  $\frac{7}{10}$  ,  $\frac{11}{15}$

$\downarrow$   $\downarrow$

$\frac{21}{30}$  ,  $\frac{22}{30}$



$$10 = 2 \times 5$$

$$15 = 3 \times 5$$

$$\text{LCM} = 2 \times 5 \times 3 = 30$$

### Check your understanding

Change into like denominator fractions using LCM of the unlike denominators.

a.  $\frac{7}{8}$  ,  $\frac{5}{24}$

b.  $\frac{5}{22}$  ,  $\frac{9}{11}$

c.  $\frac{8}{15}$  ,  $\frac{5}{6}$



## Exercise 1

on lesson 1

REMEMBER UNDERSTAND APPLY PROBLEM SOLVING

From the school book

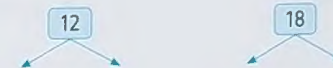
## Finding Like Denominators Using the LCM

1. Change each pair of unlike denominator fractions into like denominator fractions using LCM of the unlike denominators.

a.  $\frac{5}{12}$  and  $\frac{7}{18}$

$\downarrow$   $\downarrow$

$\frac{\quad}{\quad}$  and  $\frac{\quad}{\quad}$



$$12 = \quad$$

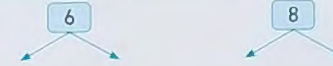
$$18 = \quad$$

$$\text{LCM} = \quad$$

b.  $\frac{7}{6}$  and  $\frac{3}{8}$

$\downarrow$   $\downarrow$

$\frac{\quad}{\quad}$  and  $\frac{\quad}{\quad}$



$$6 = \quad$$

$$8 = \quad$$

$$\text{LCM} = \quad$$

c.  $\frac{2}{3}$  and  $\frac{4}{7}$

$\downarrow$   $\downarrow$

$\frac{\quad}{\quad}$  and  $\frac{\quad}{\quad}$

$$3 = \quad$$

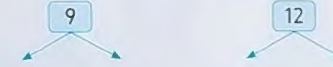
$$7 = \quad$$

$$\text{LCM} = \quad$$

d.  $\frac{7}{9}$  and  $\frac{11}{12}$

$\downarrow$   $\downarrow$

$\frac{\quad}{\quad}$  and  $\frac{\quad}{\quad}$



$$9 = \quad$$

$$12 = \quad$$

$$\text{LCM} = \quad$$

2. Using the LCM Find the smallest like denominator for the fractions listed. Then, change each fraction so that each fraction is rewritten with the smallest like denominator.

a.  $\frac{4}{9}$  and  $\frac{2}{3}$

b.  $\frac{5}{6}$  and  $\frac{3}{8}$

c.  $\frac{1}{3}$  and  $\frac{2}{7}$

d.  $\frac{2}{3}$  and  $\frac{1}{4}$

e.  $\frac{1}{5}$  and  $\frac{1}{4}$

f.  $\frac{3}{4}$  and  $\frac{5}{12}$

g.  $\frac{2}{9}$  and  $\frac{7}{12}$

h.  $\frac{5}{8}$  and  $\frac{7}{12}$

3. Bassem painted  $\frac{1}{6}$  of the wall in red and  $\frac{3}{4}$  of the same wall in blue. Draw a visual model to represent that and color it, then write the colored fractions of the wall in the same denominator.








4. Draw a visual model to answer the question.

Aya and Doha are planting flowers in their gardens. Aya has enough flowers to take up  $\frac{2}{3}$  of her garden. Doha will plant flowers in  $\frac{3}{5}$  of her garden. They decide to write their fractions with like denominators.



## Multiple Choice Questions

Choose the correct answer.

1. Which of the following is not equivalent to  $\frac{15}{20}$  ?  
 A.  $\frac{3}{4}$  B.  $\frac{30}{40}$   
 C.  $\frac{25}{100}$  D.  $\frac{9}{12}$
2. The two like denominator fractions which are equivalent to the two fractions  $\frac{2}{5}$  and  $\frac{3}{15}$  are \_\_\_\_\_  
 A.  $\frac{5}{15}$ ,  $\frac{3}{15}$  B.  $\frac{2}{5}$ ,  $\frac{1}{5}$   
 C.  $\frac{2}{5}$ ,  $\frac{3}{5}$  D.  $\frac{8}{20}$ ,  $\frac{5}{20}$
3. The two like denominator fractions represent the models  are \_\_\_\_\_  
 A.  $\frac{3}{4}$ ,  $\frac{1}{3}$  B.  $\frac{6}{8}$ ,  $\frac{2}{8}$  C.  $\frac{8}{12}$ ,  $\frac{4}{12}$  D.  $\frac{9}{12}$ ,  $\frac{4}{12}$
4. Which of the following are unlike denominator fractions ?  
 A.  B.   
 C.  D. 
5. The LCM of denominators of  $\frac{6}{12}$  and  $\frac{4}{18}$  is \_\_\_\_\_  
 A. 12 B. 36  
 C. 24 D. 6
6. The smallest like denominator of  $\frac{3}{4}$  and  $\frac{4}{5}$  is \_\_\_\_\_  
 A. 20 B. 10  
 C. 12 D. 40
7. The fractions which are equivalent to  $\frac{5}{6}$  and  $\frac{7}{8}$  with the like denominator are \_\_\_\_\_  
 A.  $\frac{15}{18}$ ,  $\frac{14}{18}$  B.  $\frac{20}{48}$ ,  $\frac{42}{48}$  C.  $\frac{10}{12}$ ,  $\frac{10}{12}$  D.  $\frac{20}{24}$ ,  $\frac{21}{24}$
8. Which of the following is equivalent to the pair of fractions  $\frac{5}{6}$  and  $\frac{1}{4}$  using the LCM of their denominators ?  
 A.  $\frac{20}{24}$ ,  $\frac{6}{24}$  B.  $\frac{10}{16}$ ,  $\frac{4}{16}$  C.  $\frac{10}{12}$ ,  $\frac{3}{12}$  D.  $\frac{40}{48}$ ,  $\frac{12}{48}$

# Lessons 2 & 3

- Estimating Sums and Differences of Fractions
- Using Models to Add and Subtract Fractions with Unlike Denominators

## Learn 1 Using benchmark fractions to estimate sums and differences of fractions

- In the market, Nader wrote a fraction to represent the remaining pieces out of the whole package of some goods, then he estimated them using benchmark fractions as follows :



$$\frac{1}{6}$$

Close to 0 package



$$\frac{5}{9}$$

Close to  $\frac{1}{2}$  package



$$\frac{7}{8}$$

Close to 1 package

### Remarks

If the numerator is much less than half the denominator, the fraction is close to 0

If the numerator is about half the denominator, the fraction is close to  $\frac{1}{2}$

If the numerator is much more than half the denominator, the fraction is close to 1

**Problem :** Father asked Nader to estimate sums and differences of fractions using benchmarks.

a.  $\frac{1}{6} + \frac{5}{9}$

b.  $\frac{7}{8} - \frac{5}{9}$

c.  $\frac{7}{8} + \frac{5}{9}$

Answer: a.  $\frac{1}{6} + \frac{5}{9}$  is estimated as  $0 + \frac{1}{2} = \frac{1}{2}$

b.  $\frac{7}{8} - \frac{5}{9}$  is estimated as  $1 - \frac{1}{2} = \frac{1}{2}$

c.  $\frac{7}{8} + \frac{5}{9}$  is estimated as  $1 + \frac{1}{2} = 1\frac{1}{2}$

## Example 1

Estimate the sums and the differences. Using the benchmarks 0,  $\frac{1}{2}$  and 1

a.  $\frac{4}{5} + \frac{4}{7}$

b.  $\frac{10}{12} + \frac{14}{15}$

c.  $\frac{7}{8} - \frac{4}{9}$

d.  $\frac{5}{6} - \frac{1}{4}$

### Solution

a.  $\frac{4}{5} + \frac{4}{7}$  is estimated as  $1 + \frac{1}{2} = 1\frac{1}{2}$

b.  $\frac{10}{12} + \frac{14}{15}$  is estimated as  $1 + 1 = 2$

c.  $\frac{7}{8} - \frac{4}{9}$  is estimated as  $1 - \frac{1}{2} = \frac{1}{2}$

d.  $\frac{5}{6} - \frac{1}{4}$  is estimated as  $1 - 0 = 1$



## Learn 2 Using models to add and subtract fractions with unlike denominators

- How to use fraction wall to find the following :

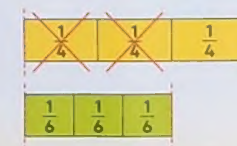
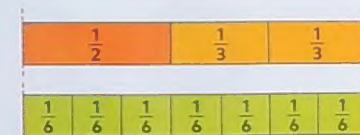
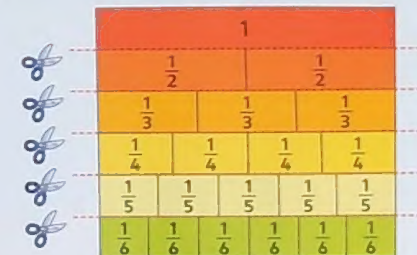
a.  $\frac{1}{2} + \frac{2}{3}$

b.  $\frac{3}{4} - \frac{3}{6}$

Answer :

- 1 Draw fraction wall pieces, then color each bar by a different color and cut the fraction wall pieces apart.

- 2 Use the fraction wall pieces to add and subtract.



a.  $\frac{1}{2} + \frac{2}{3} = \frac{7}{6}$

b.  $\frac{3}{4} - \frac{3}{6} = \frac{1}{4}$

## Example 2

Use models to find the following.

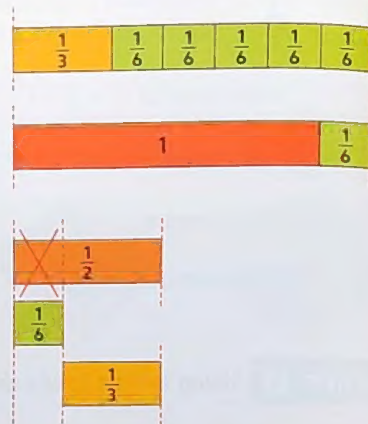
a.  $\frac{1}{3} + \frac{5}{6}$

b.  $\frac{1}{2} - \frac{1}{6}$

**Solution**

a.  $\frac{1}{3} + \frac{5}{6} = 1\frac{1}{6}$

b.  $\frac{1}{2} - \frac{1}{6} = \frac{1}{3}$



**Check** your understanding

Use your fraction wall to evaluate each sum or difference.

a.  $\frac{1}{2} + \frac{3}{4}$

b.  $\frac{5}{6} - \frac{1}{2}$

c.  $\frac{3}{5} - \frac{1}{2}$



## Exercise 2

on lessons 2&3

REMEMBER

UNDERSTAND

APPLY

PROBLEM SOLVING

From the school book

- Estimating Sums and Differences of Fractions
- Using Models to Add and Subtract Fractions with Unlike Denominators

1. Put (✓) for the suitable benchmark.

Fraction	0	$\frac{1}{2}$	1
$\frac{4}{9}$			
$\frac{1}{12}$			
$\frac{11}{13}$			
$\frac{9}{20}$			
$\frac{2}{15}$			

2. Estimate the following fractions and then find the sum or the difference.

Use the benchmarks 0,  $\frac{1}{2}$  and 1.

a.  $\frac{3}{7} + \frac{3}{5} = \text{---} + \text{---} = \text{---}$

b.  $\frac{2}{9} + \frac{4}{7} = \text{---} + \text{---} = \text{---}$

c.  $\frac{9}{12} + \frac{7}{15} = \text{---} + \text{---} = \text{---}$

d.  $\frac{1}{4} + \frac{2}{3} = \text{---} + \text{---} = \text{---}$

e.  $\frac{4}{9} + \frac{7}{8} = \text{---} + \text{---} = \text{---}$

f.  $\frac{8}{9} - \frac{6}{7} = \text{---} - \text{---} = \text{---}$

g.  $\frac{4}{5} - \frac{5}{8} = \text{---} - \text{---} = \text{---}$

h.  $\frac{7}{13} - \frac{1}{4} = \text{---} - \text{---} = \text{---}$

i.  $\frac{5}{6} - \frac{7}{12} = \text{---} - \text{---} = \text{---}$

j.  $\frac{3}{4} - \frac{2}{3} = \text{---} - \text{---} = \text{---}$

3. Indicate whether the given estimate is an overestimate or an underestimate.

a.  $\frac{9}{10} + \frac{2}{5}$  is about  $1\frac{1}{2}$

[Overestimate or Underestimate]

b.  $\frac{3}{5} + \frac{6}{10}$  is about 1

[Overestimate or Underestimate]

c.  $\frac{1}{3} + \frac{5}{9}$  is about  $\frac{1}{2}$

[Overestimate or Underestimate]

d.  $\frac{2}{5} + \frac{3}{7}$  is about 1

[Overestimate or Underestimate]

e.  $\frac{9}{10} + \frac{7}{9}$  is about 2

(Overestimate or Underestimate)

f.  $\frac{7}{12} + \frac{12}{11}$  is about  $1\frac{1}{2}$

(Overestimate or Underestimate)

4. Use your fraction wall to evaluate each sum or difference.

a.  $\frac{2}{3} + \frac{1}{4} =$

b.  $\frac{1}{3} + \frac{1}{6} =$

c.  $\frac{1}{3} + \frac{5}{6} =$

d.  $\frac{2}{4} - \frac{2}{8} =$

e.  $\frac{3}{5} - \frac{1}{2} =$

f.  $\frac{5}{9} - \frac{1}{3} =$

g.  $\frac{1}{4} + \frac{1}{3} =$

h.  $\frac{7}{12} - \frac{1}{3} =$

i.  $\frac{3}{10} - \frac{1}{5} =$

j.  $\frac{5}{8} + \frac{1}{4} =$

k.  $\frac{3}{4} + \frac{1}{3} =$

l.  $\frac{1}{2} - \frac{2}{6} =$

m.  $\frac{7}{10} - \frac{1}{2} =$

n.  $\frac{1}{5} + \frac{3}{10} =$

o.  $\frac{4}{5} - \frac{1}{2} =$

p.  $\frac{1}{2} + \frac{3}{4} =$



5. Kamel says that  $\frac{11}{12} - \frac{7}{10}$  will be about  $\frac{1}{2}$ . Fady says that  $\frac{11}{12} - \frac{7}{10}$  will be close to 0.

Do you agree with Kamel or Fady? Explain your thinking.



6. Hend and Gehad evaluated the given expression.

$$\frac{7}{8} - \frac{3}{4}$$

Gehad said that the difference is  $\frac{4}{4}$ , and Hend said that the difference is  $\frac{1}{8}$ .

Who is correct? Show your work and explain your thinking using numbers, words, and pictures.

## Multiple Choice Questions

Choose the correct answer.

1.  $\frac{5}{6} + \frac{3}{7}$  is estimated as

- A. 1 + 1      B.  $\frac{1}{2} + \frac{1}{2}$       C. 1 + 0      D.  $1 + \frac{1}{2}$

2. Estimate the sum of  $\frac{3}{8} + \frac{4}{5}$  using benchmarks, the sum is

- A. 2      B.  $1\frac{1}{2}$       C. 1      D.  $\frac{1}{2}$

3. Estimate the difference  $\frac{9}{10} - \frac{7}{8}$  using benchmarks, the difference is

- A. 1      B. 0      C.  $\frac{1}{2}$       D. 2

4. When estimate the sum of  $\frac{8}{10} + \frac{2}{5}$  is about  $1\frac{1}{2}$ , the estimation is

- A. overestimate      B. underestimate

5. Which of the following is underestimate?

- A.  $\frac{3}{4} + \frac{3}{8}$  is about  $1\frac{1}{2}$       B.  $\frac{5}{8} + \frac{4}{7}$  is about 1  
C.  $\frac{4}{5} + \frac{2}{5}$  is about  $1\frac{1}{2}$       D.  $\frac{3}{7} + \frac{4}{10}$  is about 1

6. Which of the following is overestimate?

- A.  $\frac{6}{10} + \frac{1}{9}$  is about  $\frac{1}{2}$       B.  $\frac{7}{8} + \frac{5}{9}$  is about  $\frac{1}{2}$   
C.  $\frac{5}{8} + \frac{7}{12}$  is about 1      D.  $\frac{8}{9} + \frac{5}{11}$  is about  $1\frac{1}{2}$

7. Using the fraction tiles, the sum of:  $\frac{2}{3} + \frac{5}{6} =$

- A.  $1\frac{1}{2}$       B.  $\frac{7}{9}$       C.  $\frac{4}{3}$       D.  $\frac{11}{6}$

8. Using the fraction tiles, the difference of:  $\frac{3}{4} - \frac{1}{3} =$

- A.  $\frac{1}{2}$       B.  $\frac{1}{4}$       C.  $\frac{5}{12}$       D.  $\frac{1}{3}$

# Lessons 4 & 5

- Adding and Subtracting Fractions with Unlike Denominators, Part 1
- Adding and Subtracting Fractions with Unlike Denominators, Part 2

**Learn 1** Adding and subtracting fractions where denominator of one of them is a multiple of the other

- 1 To add or subtract fractions of unlike denominators, first you must write the fractions with like denominator.
- 2 When one of the two denominators is a multiple of the other. You take this multiple as a common denominator.

**Problem:** Find.

a.  $\frac{5}{8} + \frac{1}{4}$

b.  $\frac{5}{6} - \frac{2}{3}$

Answer:

a.  $\frac{5}{8} + \frac{1}{4}$

The denominator 8 is a multiple of the denominator 4

$\frac{5}{8} + \frac{2}{8}$

Take the multiple 8 as a common denominator and replace  $\frac{1}{4}$  by its equivalent fraction  $\frac{2}{8}$

$\frac{5}{8} + \frac{1}{4} = \frac{5}{8} + \frac{2}{8} = \frac{7}{8}$

Find the sum

b.  $\frac{5}{6} - \frac{2}{3}$

The denominator 6 is a multiple of the denominator 3

$\frac{5}{6} - \frac{4}{6}$

Take the multiple 6 as a common denominator and replace  $\frac{2}{3}$  by its equivalent fraction  $\frac{4}{6}$

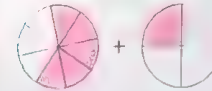
$\frac{5}{6} - \frac{2}{3} = \frac{5}{6} - \frac{4}{6} = \frac{1}{6}$

Find the difference

## Using models to find sum or difference

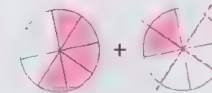
You can solve the previous problem using models as the following.

a.  $\frac{5}{8} + \frac{1}{4}$



$\frac{5}{8} + \frac{1}{4}$

Change the model for  $\frac{1}{4}$  so that it has the same number of sections as the model for  $\frac{5}{8}$ .



$\frac{5}{8} + \frac{2}{8}$



Add  $\frac{2}{8}$  to the model for  $\frac{5}{8}$

b.  $\frac{5}{6} - \frac{2}{3}$



$\frac{5}{6} - \frac{2}{3}$

Change the model for  $\frac{2}{3}$  so that it has the same number of sections as the model for  $\frac{5}{6}$ .



$\frac{5}{6} - \frac{4}{6}$



Take away  $\frac{4}{6}$  from the model for  $\frac{5}{6}$

## Example 1

Find.

a.  $\frac{3}{5} + \frac{1}{10}$

b.  $\frac{7}{8} - \frac{3}{4}$

## Solution

a.  $\frac{3}{5} + \frac{1}{10}$

$\frac{6}{10} + \frac{1}{10} = \frac{7}{10}$

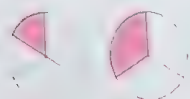
b.  $\frac{7}{8} - \frac{3}{4}$

$\frac{7}{8} - \frac{6}{8} = \frac{1}{8}$

## Example 2

Use models to find.

a.  $\frac{1}{6} + \frac{1}{3}$



**Solution**



$$\frac{1}{6} + \frac{2}{6} = \frac{3}{6} = \frac{1}{2}$$

b.  $\frac{7}{8} - \frac{1}{2}$



$$\frac{7}{8} - \frac{4}{8} = \frac{3}{8}$$

**Check** your understanding

Find.

a.  $\frac{5}{16} + \frac{3}{8}$

b.  $\frac{7}{9} - \frac{1}{3}$

c.  $\frac{2}{7} + \frac{3}{14}$

d.  $\frac{7}{10} - \frac{1}{5}$



## Learn 2 Adding and subtracting unlike denominator fractions

- 1 To add or subtract fractions of unlike denominators, first you must write the fractions with like denominator.
- 2 We take the LCM of the two denominator as like denominator of the two fractions.

**Problem:** Find.

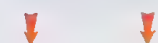
a.  $\frac{3}{10} + \frac{4}{15}$

b.  $\frac{7}{8} - \frac{1}{6}$

Answer

a.  $\frac{3}{10} + \frac{4}{15}$

LCM of the two denominators is 30



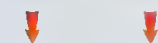
$$\frac{9}{30} + \frac{8}{30}$$

Take 30 as a common denominator and replace each fraction by an equivalent one.

$$\frac{3}{10} + \frac{4}{15} = \frac{9}{30} + \frac{8}{30} = \frac{17}{30}$$

b.  $\frac{7}{8} - \frac{1}{6}$

LCM of the two denominators is 24



$$\frac{21}{24} - \frac{4}{24}$$

Take 24 as a common denominator and replace each fraction by an equivalent one.

$$\frac{7}{8} - \frac{1}{6} = \frac{21}{24} - \frac{4}{24} = \frac{17}{24}$$

**Remember**

$$\begin{array}{l} 10 = 2 \times 5 \\ 15 = 3 \times 5 \\ \text{LCM} = 2 \times 3 \times 5 = 30 \end{array}$$

**Remember**

$$\begin{array}{l} 8 = 2 \times 2 \times 2 \\ 6 = 2 \times 3 \\ \text{LCM} = 2 \times 2 \times 2 \times 3 = 24 \end{array}$$



### Example 3

Find.

a.  $\frac{2}{3} + \frac{3}{4}$

b.  $\frac{1}{2} - \frac{1}{5}$

c.  $1 + \frac{9}{10} + \frac{3}{5}$

d.  $2 - \frac{2}{9} - \frac{5}{6}$

**Solution** 


a.  $\frac{2}{3} + \frac{3}{4} = \frac{8}{12} + \frac{9}{12} = \frac{17}{12} = 1\frac{5}{12}$

b.  $\frac{1}{2} - \frac{1}{5} = \frac{5}{10} - \frac{2}{10} = \frac{3}{10}$

c.  $1 + \frac{9}{10} + \frac{3}{5} = \frac{10}{10} + \frac{9}{10} + \frac{6}{10} = \frac{25}{10} = \frac{5}{2} = 2\frac{1}{2}$

d.  $2 - \frac{2}{9} - \frac{5}{6} = \frac{36}{18} - \frac{4}{18} - \frac{15}{18} = \frac{32}{18} - \frac{15}{18} = \frac{17}{18}$



 **Check** your understanding

Find each of the following, then use estimation to check reasonability of your answer.

a.  $\frac{3}{8} + \frac{1}{3}$

b.  $\frac{7}{9} - \frac{1}{6}$

c.  $\frac{2}{5} + \frac{3}{8} + 1$

d.  $1 - \frac{1}{4} - \frac{1}{5}$

### Exercise 3

3

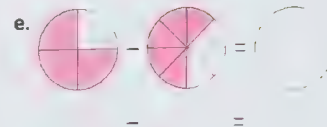
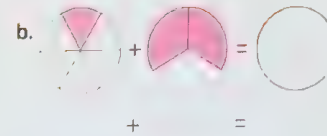
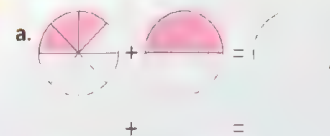
on lessons 4&5

REMEMBER UNDERSTAND APPLY PROBLEM SOLVING

From the school book

- Adding and Subtracting Fractions with Unlike Denominators, Part 1
- Adding and Subtracting Fractions with Unlike Denominators, Part 2

1. Find each of the following.



2. Evaluate by rewriting the fractions with like denominators. Use estimation to check that your answer is reasonable.

Problem	Evaluation by rewriting fractions with like denominator	Estimation using benchmarks	Reasonable / Not reasonable
a. $\frac{1}{2} + \frac{1}{8}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
b. $\frac{3}{4} + \frac{5}{12}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
c. $\frac{15}{15} - \frac{2}{3}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
d. $\frac{5}{8} - \frac{1}{2}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	

e. $\frac{7}{9} - \frac{1}{3}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
f. $\frac{4}{5} + \frac{1}{20}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
g. $\frac{1}{2} + \frac{11}{12}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
h. $\frac{5}{8} - \frac{1}{2}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
i. $\frac{3}{5} + \frac{7}{10}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
j. $\frac{7}{14} + \frac{1}{7}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
k. $\frac{5}{9} - \frac{1}{3}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
l. $\frac{7}{9} - \frac{2}{3}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
m. $\frac{6}{7} - \frac{3}{14}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
n. $\frac{5}{12} - \frac{1}{4}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
o. $\frac{5}{6} - \frac{4}{30}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
p. $\frac{3}{4} + \frac{5}{8}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
q. $\frac{4}{5} - \frac{3}{10}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
r. $\frac{5}{12} - \frac{7}{36}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
s. $\frac{2}{3} - \frac{17}{30}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} - \frac{\quad}{\quad} = \frac{\quad}{\quad}$	
t. $\frac{5}{9} + \frac{1}{18}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	$\frac{\quad}{\quad} + \frac{\quad}{\quad} = \frac{\quad}{\quad}$	

3. Estimate each sum or difference. Then, evaluate each expression by rewriting the fractions with like denominators.

a. $\frac{1}{3} + \frac{1}{4} = \frac{\quad}{\quad}$	b. $\frac{1}{2} - \frac{2}{5} = \frac{\quad}{\quad}$	c. $\frac{1}{3} - \frac{1}{4} = \frac{\quad}{\quad}$
d. $\frac{5}{6} + \frac{3}{8} = \frac{\quad}{\quad}$	e. $\frac{1}{2} + \frac{2}{5} = \frac{\quad}{\quad}$	f. $\frac{5}{6} - \frac{3}{8} = \frac{\quad}{\quad}$
g. $\frac{3}{5} + \frac{1}{3} = \frac{\quad}{\quad}$	h. $\frac{1}{6} + \frac{5}{8} = \frac{\quad}{\quad}$	i. $\frac{11}{12} - \frac{7}{8} = \frac{\quad}{\quad}$
j. $\frac{7}{9} - \frac{1}{6} = \frac{\quad}{\quad}$	k. $\frac{1}{5} + \frac{1}{2} = \frac{\quad}{\quad}$	l. $\frac{1}{8} + \frac{3}{5} + \frac{9}{10} = \frac{\quad}{\quad}$
m. $\frac{5}{9} + \frac{1}{2} = \frac{\quad}{\quad}$	n. $1 - \frac{1}{4} - \frac{1}{6} = \frac{\quad}{\quad}$	o. $\frac{3}{4} - \frac{1}{3} = \frac{\quad}{\quad}$
p. $1 + \frac{7}{10} + \frac{3}{4} = \frac{\quad}{\quad}$	q. $\frac{1}{2} + \frac{1}{3} = \frac{\quad}{\quad}$	r. $2 - \frac{7}{9} - \frac{1}{6} = \frac{\quad}{\quad}$

4. Add.

a. $\frac{1}{3} + \frac{1}{4}$	b. $\frac{1}{5} + \frac{1}{3}$	c. $\frac{1}{2} + \frac{1}{7}$
d. $\frac{1}{4} + \frac{1}{8}$	e. $\frac{1}{6} + \frac{1}{8}$	f. $\frac{3}{7} + \frac{1}{6}$
g. $\frac{2}{3} + \frac{3}{4}$	h. $\frac{3}{7} + \frac{4}{5}$	i. $\frac{1}{4} + \frac{3}{10}$
j. $\frac{7}{8} + \frac{5}{6}$	k. $\frac{2}{3} + \frac{7}{8}$	l. $\frac{5}{9} + \frac{2}{5}$

5. Subtract.

a. $\frac{1}{3} - \frac{1}{5}$	b. $\frac{5}{6} - \frac{1}{2}$	c. $\frac{5}{6} - \frac{1}{3}$
d. $\frac{1}{4} - \frac{1}{5}$	e. $\frac{4}{7} - \frac{1}{3}$	f. $\frac{2}{3} - \frac{1}{6}$
g. $\frac{2}{5} - \frac{1}{10}$	h. $\frac{4}{5} - \frac{1}{4}$	i. $\frac{9}{10} - \frac{3}{5}$
j. $\frac{5}{6} - \frac{2}{3}$	k. $\frac{7}{8} - \frac{2}{5}$	l. $\frac{5}{6} - \frac{3}{8}$

6. Who is correct? Soliman, Seif, and Samar each added these fractions.

Who is correct? Why?

$$\frac{1}{12} + \frac{2}{3}$$

Soliman's answer:  $\frac{9}{12}$

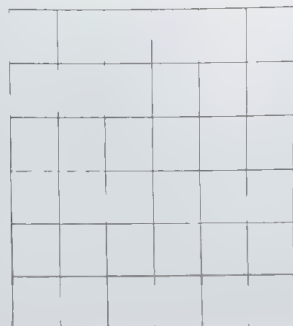
Seif's answer:  $\frac{3}{15}$

Samar's answer:  $\frac{3}{4}$

- Is Soliman correct? Why or why not?
- Is Seif correct? Why or why not?
- Is Samar correct? Why or why not?

7. Abeer, Badr, Ehab, and Doha are making a quilt of 36 equal-sized fabric squares to represent flowering plants in Egypt. Abeer made squares for  $\frac{11}{36}$  of the quilt's area. Badr made squares for  $\frac{1}{6}$  of the quilt's area. What fraction of the quilt must Ehab make so that  $\frac{1}{6}$  of the quilt's area will remain for Doha?

Represent different squares needed for given fractions of a quilt. Label the diagram and explain your thinking.



8. Write three different addition problems and three different subtraction problems using the given fractions. Then, find each sum or difference.

$$\frac{1}{2} \quad \frac{4}{9} \quad \frac{3}{8} \quad \frac{5}{6} \quad \frac{2}{5}$$

$$\frac{1}{21} \quad \frac{8}{11} \quad \frac{6}{7} \quad \frac{7}{12} \quad \frac{9}{10}$$



## Multiple Choice Questions

Choose the correct answer.

1.  $\frac{2}{5} + \frac{3}{10} =$

- A.  $\frac{5}{15}$  B.  $\frac{7}{10}$  C.  $\frac{5}{10}$  D.  $\frac{1}{2}$

2.  $\frac{3}{4} - \frac{5}{8} =$

- A.  $\frac{1}{4}$  B.  $\frac{1}{8}$  C.  $\frac{3}{8}$  D.  $\frac{5}{8}$

3. + =

- A. 1 B.  $\frac{5}{4}$   
C.  $\frac{7}{8}$  D.  $\frac{9}{8}$

4. - =

- A.  $\frac{2}{6}$  B.  $\frac{1}{2}$   
C.  $\frac{5}{6}$  D.  $\frac{1}{3}$

5.  $\frac{5}{9} + \frac{1}{3} =$

- A.  $\frac{7}{9}$  B.  $\frac{6}{12}$  C.  $\frac{8}{9}$  D.  $\frac{5}{27}$

6.  $\frac{6}{7} - \frac{1}{42} =$

- A.  $\frac{5}{6}$  B.  $\frac{6}{5}$  C.  $\frac{1}{7}$  D.  $\frac{36}{42}$

7.  $\frac{2}{5} + \frac{3}{8} =$

- A.  $\frac{5}{40}$  B.  $\frac{31}{40}$  C.  $\frac{6}{40}$  D.  $\frac{5}{13}$

8.  $\frac{2}{7} + \frac{2}{5} =$

- A.  $\frac{4}{35}$  B.  $\frac{4}{13}$  C.  $\frac{4}{12}$  D.  $\frac{24}{35}$

9.  $\frac{4}{5} - \frac{3}{4} =$

- A.  $\frac{7}{20}$  B.  $\frac{15}{20}$  C.  $\frac{1}{20}$  D.  $\frac{3}{20}$

10.  $1 - \frac{1}{4} - \frac{1}{6} =$

- A.  $\frac{7}{12}$  B.  $\frac{1}{12}$  C.  $\frac{5}{6}$  D.  $\frac{3}{4}$

11.  $1 + \frac{1}{2} + \frac{3}{4} =$

- A.  $\frac{5}{6}$  B.  $2\frac{1}{4}$  C.  $2\frac{9}{20}$  D.  $2\frac{1}{2}$

12.  $\frac{5}{12} + \frac{1}{4}$       $\frac{1}{3} + \frac{1}{4}$

- A. > B. < C. =

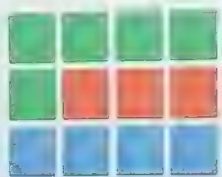
# Lesson

## 6

### Solving Story Problems with Fractions

#### Learn 1 Building arrays with color tiles to find the fractional parts of the model

Use 12 colored tiles : 5 green, 4 blue and 3 red

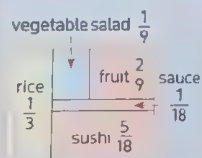


, then answer the following questions :

- 1 What fraction of the array is green ?  
The answer :  $\frac{5}{12}$
- 2 What fraction of the array is blue ?  
The answer :  $\frac{4}{12} = \frac{1}{3}$
- 3 What fraction of the array is red ?  
The answer :  $\frac{3}{12} = \frac{1}{4}$
- 4 What color represents  $\frac{1}{3}$  of the array ?  
The answer : blue
- 5 How many tiles equal  $\frac{1}{4}$  of the array ?  
The answer : 3 tiles



Japanese bento boxes are often divided into sections for different foods this bento box is divided into 5 sections



#### Check your understanding

Use 16 tiles to build arrays with color tiles 4 red, 5 green and 7 blue.

1. What fraction of the array is green ? \_\_\_\_\_
2. What color represents  $\frac{1}{4}$  of the array ? \_\_\_\_\_

#### Learn 2 Solving story problems involving addition and subtraction with fractions

**Problem :**  $\frac{1}{3}$  of the school garden has vegetables and  $\frac{1}{2}$  of the garden has flowers, what part of the garden is left to grow grass ?

**Answer :** We have 2 methods to solve this problem.

##### 1st method : Using addition and subtraction

- 1 Add  $\frac{1}{3}$  and  $\frac{1}{2}$  to find out what fraction represents vegetable and flowers parts.

$$\frac{1}{3} + \frac{1}{2} = \frac{2}{6} + \frac{3}{6} = \frac{5}{6}$$

LCM of 2 and 3 is 6

- 2 The whole garden is  $1 = \frac{6}{6}$ , then subtract vegetables and flowers parts from it to get the left part to grow grass.

$$\frac{6}{6} - \frac{5}{6} = \frac{1}{6}$$

##### 2nd method : Using model tiles

- 1 Find LCM of the two given fraction denominators.  
→ The LCM of 3 and 2 is 6
- 2 Draw tiles model consists of 6 equal parts.



- 3 Write vegetable inside  $\frac{1}{3}$  of the tiles and flowers inside  $\frac{1}{2}$  of them and grass inside the left tiles.

flowers	flowers	flowers
vegetable	vegetable	grass

- 4 Deduce that  $\frac{1}{6}$  of garden is left to grow grass.

### Example 1

Students in a class completed a survey about their favourite sports,  $\frac{2}{5}$  of the students favourite handball,  $\frac{1}{4}$  of the students favourite basketball and the left students favourite football.

What is the fraction represents the students that their favourite sport is football ?

### Solution

The fraction represents the students that their favourite sports are handball and basketball.

$$\frac{2}{5} + \frac{1}{4} = \frac{8}{20} + \frac{5}{20} = \frac{13}{20}$$

LCM of 5 and 4 is 20

The fraction represents the student that their favourite sport is football.

$$1 - \frac{13}{20} = \frac{20}{20} - \frac{13}{20} = \frac{7}{20}$$

, then  $\frac{7}{20}$  of the students their favourite sport is football.

### Another solution :

- LCM of denominators of  $\frac{2}{5}$  and  $\frac{1}{4}$  is 20

- Draw tiles model of 20 equal parts, in  $\frac{2}{5}$  of them write handball, in  $\frac{1}{4}$  of them write basketball and football in the left tiles.

handball	handball	handball	handball	handball
handball	handball	handball	basketball	basketball
basketball	basketball	basketball	football	football
football	football	football	football	football

- $\frac{7}{20}$  of the students their favourite sport is football.

### Check your understanding

Wael spends  $\frac{4}{7}$  of his money on candy and  $\frac{1}{5}$  of his money on toys and saves the left money. What fraction of money does Wael save ?

### Learn 3 Story problems with fractions and whole numbers

**Problem :** Nancy read  $\frac{1}{3}$  of a book in the morning and  $\frac{2}{5}$  of the same book in the evening, then 32 pages of the book are left without reading.

What is the number of pages in the book ?

**Answer** 1 LCM of 5 and 3 is 15

- Draw model tiles of 15 equal parts.


- Write on  $\frac{1}{3}$  of tiles "morning", on  $\frac{2}{5}$  of tiles write evening and on the left tiles write "left".

morning	morning	morning	morning	morning
evening	evening	evening	evening	evening
evening	left	left	left	left

- $\frac{4}{15}$  of the book is left which is 32 pages, since  $4 \times 8 = 32$ , then each tile represents 8 pages.

8	8	8	8	8
8	8	8	8	8
8	8	8	8	8

Then, the book pages  
=  $15 \times 8 = 120$  pages.

### Note that

The previous problem can be solved as the following.

$$1 \text{ Find fraction of read pages in morning and evening } = \frac{1}{3} + \frac{2}{5} = \frac{5}{15} + \frac{6}{15} = \frac{11}{15}$$

$$2 \text{ Find fraction of left pages } = 1 - \frac{11}{15} = \frac{15}{15} - \frac{11}{15} = \frac{4}{15}$$

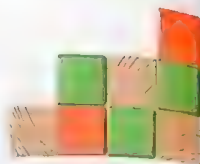
$$3 \text{ } \frac{4}{15} \text{ of the book is 32 pages, then } \frac{4}{15} = \frac{32}{120}$$

→ The number of all pages in the book is 120 pages.

## Example 2

Hany has some small wooden cubes, he paints  $\frac{1}{3}$  of them in green and  $\frac{1}{4}$  of them in red and 15 cubes are left without painting.

What is the total number of cubes?



### Solution

1. The fraction of painted cubes =  $\frac{1}{3} + \frac{1}{4} = \frac{4}{12} + \frac{3}{12} = \frac{7}{12}$

LCM of 3 and 4 is 12

2. The fraction of left cubes =  $1 - \frac{7}{12} = \frac{12}{12} - \frac{7}{12} = \frac{5}{12}$

3.  $\frac{5}{12}$  of cubes is 15,  $5 \times 3 = 15$

, then total number of cubes =  $12 \times 3 = 36$  cubes

$$\begin{array}{r} \times 3 \\ \frac{5}{12} = \frac{15}{36} \\ \times 3 \end{array}$$

### Another solution :

1. LCM of 3 and 4 is 12

2. Draw 12 tiles model.

$\frac{1}{3}$  of them for green and  $\frac{1}{4}$  of them for red.

3.  $\frac{5}{12}$  of cubes are left which are 15 cubes, since  $15 = 5 \times 3$ , then each tile represents 3 cubes.

Total number of cubes =  $12 \times 3 = 36$

green	green	green	green
red	red	red	left
left	left	left	left

3	3	3	3
3	3	3	3
3	3	3	3

### Check your understanding

Roudy and Sama bought some cookies, Roudy ate  $\frac{3}{8}$  of them and Sama ate  $\frac{1}{3}$  of them and 14 cookies are left.

What is the number of cookies did Roudy and Sama buy?

## Exercise 4

on lesson 6

REMEMBER UNDERSTAND APPLY PROBLEM SOLVING

From the school book

## Solving Story Problems with Fractions

1. Soha likes chocolate. One day she bought a chocolate and ate  $\frac{5}{9}$  of it in the morning and  $\frac{1}{3}$  in the evening.

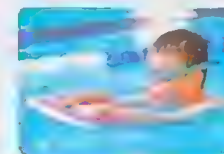
How much part of the chocolate has she eaten?



2. Omnia purchases  $\frac{8}{9}$  kg of fava beans. She uses  $\frac{3}{4}$  kg of the fava beans to make falafel. How many kilograms of fava beans are left?

3. A piece of ribbon is  $\frac{12}{15}$  m long. A piece of  $\frac{4}{15}$  m is cut from it. What is the fraction of the remaining ribbon?

4. Youssef spent  $\frac{3}{4}$  of an hour biking and  $\frac{5}{6}$  of an hour jogging. Afterwards, he swam for  $\frac{1}{8}$  of an hour. How much time did Youssef exercise before he went swimming?



5. To stay healthy, Emily decided to walk for  $\frac{4}{5}$  km every day. She walked  $\frac{2}{5}$  km to work and walked  $\frac{1}{4}$  km at lunchtime. How much more does she need to walk after dinner if she wants to meet her target distance?



6. If the cup can hold  $\frac{1}{4}$  litre of liquid, Amira poured  $\frac{1}{5}$  litre of milk into the cup, how much milk can Amira add to get the cup full?



7. Build arrays with color tiles to find the fractional parts of the model.

- a. Use 9 tiles,  $\frac{1}{3}$  of which are red, and the remaining tiles are yellow.

1. How many tiles are red?

Therefore,  $\frac{1}{3}$  of 9 tiles equal \_\_\_\_\_ tiles.

2. How many tiles are yellow?

Therefore,  $\frac{2}{3}$  of 9 tiles equal \_\_\_\_\_ tiles.

- b. Use 16 tiles: 8 red, 4 yellow, 3 green, and 1 blue.

1. What fraction of the array is red?

Therefore,  $\frac{1}{2}$  of 16 tiles equal \_\_\_\_\_ tiles.

2. What fraction of the array is yellow?

Therefore,  $\frac{1}{4}$  of 16 tiles equal \_\_\_\_\_ tiles.

- c. Use 12 tiles: 4 blue, 3 green, 3 yellow, and the rest red.

1. What fraction of the array is green?

2. What fraction of the array is red?

3. What color represents  $\frac{1}{3}$  of the array?

4. How many tiles do  $\frac{1}{4}$  of 12 tiles represent?

- d. Use the fewest tiles possible to build an array that is  $\frac{1}{4}$  blue,  $\frac{2}{5}$  green,  $\frac{1}{10}$  yellow, and the rest red.

1. How many tiles did you use altogether?

2. How many tiles are included in  $\frac{1}{4}$  of the array?

3. How many tiles equal  $\frac{2}{5}$  of the array?

4. Two tiles are what fraction of the array?

8. Mother ate  $\frac{1}{3}$  of the cake and father  $\frac{3}{8}$ .

How much of the cake has been eaten and how much is left?



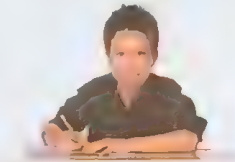
9. Wafaa's flower garden consists of  $\frac{3}{7}$  cornflowers and  $\frac{2}{5}$  poppies. The rest of the garden is filled with roses. What fraction of the Wafaa's garden is roses?

10. In the pond,  $\frac{1}{3}$  of the lilies are white and  $\frac{1}{4}$  of the lilies are pink. The remaining lilies are blue. What fraction of the lilies are blue?

11. Nancy spends  $\frac{2}{7}$  of her salary for food and uses  $\frac{1}{2}$  of her salary for paying the house rent. What fraction of salary is left?



12. Eslam spent  $\frac{1}{2}$  of his Sunday doing homework and  $\frac{1}{5}$  of the day watching cricket. What part of the day was left to do other things?



13. In the pond,  $\frac{1}{3}$  of the lilies are white and  $\frac{1}{4}$  of the lilies are pink. The remaining 30 lilies are blue. How many lilies are in the pond all together?

14. Rania uses  $\frac{3}{4}$  of her monthly salary to pay for her food, rent, utilities, and transportation. After these expenses, she is left with 1,250 L.E. What is Rania's monthly salary?

15. Ziad had 40 date palm trees for sale at his nursery. He sold  $\frac{2}{5}$  of the trees on Monday. He sold  $\frac{1}{4}$  of the remaining trees on Tuesday. Wednesday, he sold  $\frac{1}{2}$  of what was left. How many date palm trees did Ziad have remaining to sell on Thursday?

16. Osman expected his assignment to take  $\frac{4}{5}$  of an hour. He completed it in  $\frac{3}{4}$  of an hour. In how many fewer minutes did Osman complete his assignment than he expected?

17. In Wafaa's flower garden,  $\frac{3}{7}$  of the plants are cornflowers and  $\frac{2}{5}$  are poppies. The rest of the garden is filled with 6 rose plants.

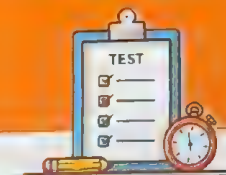
How many flower plants could be in Wafaa's garden?

Your classmate says the answer to the question is  $\frac{6}{35}$ .

Do you agree? Why or why not?



## Unit Seven Assessment



### 1. Choose the correct answer.

- a.  $\frac{5}{6} - \frac{3}{5} =$   
 A.  $\frac{8}{30}$  B.  $\frac{9}{20}$  C.  $\frac{7}{30}$  D.  $\frac{3}{4}$
- b. Which of the following is overestimate?  
 A.  $\frac{8}{7} + \frac{5}{9} = 1\frac{1}{2}$  B.  $\frac{4}{7} + \frac{3}{5} = 1$  C.  $\frac{1}{6} + \frac{6}{11} = \frac{1}{2}$  D.  $\frac{4}{9} + \frac{3}{7} = 1$
- c. Equivalent fraction of  $\frac{2}{8}$  is  
 A.  $\frac{4}{8}$  B.  $\frac{2}{4}$  C.  $\frac{1}{4}$  D.  $\frac{4}{10}$
- d. The smallest like denominator of  $\frac{2}{3}$  and  $\frac{3}{4}$  is  
 A. 6 B. 8 C. 24 D. 12
- e.  $1 - \frac{1}{3} - \frac{1}{5} =$   
 A.  $\frac{7}{20}$  B.  $\frac{7}{15}$  C.  $\frac{12}{17}$  D.  $\frac{5}{8}$
- f. =  
 A.  $\frac{1}{4}$  B.  $\frac{1}{2}$  C.  $\frac{1}{8}$  D.  $\frac{5}{8}$
- g.  $\frac{5}{7} - \frac{1}{7} =$   
 A.  $\frac{1}{7}$  B.  $\frac{4}{7}$  C.  $\frac{5}{7}$  D.  $\frac{6}{7}$

### 2. Complete.

- a.  $\frac{1}{2} + \frac{2}{5} =$
- b. Simplest form of  $\frac{15}{27}$  is
- c. Change  $\frac{5}{6}$  and  $\frac{7}{12}$  into two like denominator fractions \_\_\_\_\_,
- d.  $\frac{17}{10} - \frac{4}{10} =$
- e.  $\frac{8}{32} = \frac{4}{}$
- f. LCM of the denominators of  $\frac{2}{5}$  and  $\frac{1}{3}$  is
- g.  $\frac{7}{13} + \frac{2}{13} =$
- h.  $\frac{7}{9} - \frac{3}{9} =$

3. Choose the correct answer.

a.  is equivalent to



b.  $\frac{2}{4}$  is equivalent to

A.  $\frac{5}{8} - \frac{1}{4}$

B.  $\frac{7}{8} - \frac{1}{4}$

C.  $\frac{5}{6} - \frac{1}{3}$

D.  $1 - \frac{5}{8}$

c.  $\frac{7}{8} - \frac{2}{3}$

A.  $\frac{5}{5}$

B.  $\frac{5}{20}$

C.  $\frac{5}{8}$

D.  $\frac{5}{24}$

d.  $1 - \frac{1}{4} - \frac{2}{3} =$

A.  $\frac{7}{12}$

B.  $\frac{1}{12}$

C.  $\frac{1}{2}$

D.  $\frac{5}{12}$

e.  $\frac{3}{4} + \frac{4}{5} =$

A.  $\frac{7}{9}$

B.  $\frac{7}{20}$

C.  $1\frac{11}{20}$

D.  $\frac{12}{20}$

f.  $\frac{5}{6} - \frac{1}{3} =$

A.  $\frac{4}{3}$

B.  $\frac{1}{2}$

C.  $\frac{4}{18}$

D.  $\frac{4}{6}$

g.  $1 - \frac{\quad}{\quad} = \frac{5}{8}$

A.  $\frac{5}{8}$

B.  $\frac{3}{8}$

C.  $\frac{6}{8}$

D.  $\frac{8}{7}$

4. Answer the following.

a. Marvin spend  $\frac{1}{2}$  of her money to buy candy and  $\frac{1}{3}$  of it to buy toys.

What fraction of her money is left ?

b. In the school day break, Hany spends  $\frac{2}{3}$  of the break in eating and  $\frac{1}{5}$  of it to take a drink, then 4 minute left. What is the break time ?

c. Petra's flower garden consists of  $\frac{3}{8}$  cornflowers and  $\frac{1}{3}$  poppies. The rest of the garden is filled with roses. What fraction of the Petra's garden is roses ?

d. Estimate the sum and the difference using the benchmarks 0,  $\frac{1}{2}$  and 1

1.  $\frac{7}{8} + \frac{1}{5} =$

2.  $\frac{5}{9} + \frac{4}{7} =$

## Theme 3 | Fractions, Decimals, and Proportional Relationships

# UNIT 8

## Adding and Subtracting Mixed Numbers

» Concept 1 : Working with Mixed Numbers with Like and Unlike Denominators

» Concept 2 : Adding and Subtracting Mixed Numbers with Unlike Denominators



### Fast Fact

Hippos are considered the second largest land animal on Earth (first place goes to the elephant!).

Males measure around  $3\frac{1}{2}$  m long and  $1\frac{1}{2}$  m tall, and can weigh up 3,200 kg. That's as much as three small cars.

## Concept

# 1

## Working with Mixed Numbers with Like and Unlike Denominators

### Fast Fact

Ostrich is the world's largest bird. It stands up to massive  $2\frac{7}{10}$  m tall and weighs as much as 159kg - that's around 1m taller than the average man, and the weight of two men combined! Also, its egg is the largest egg in the world, averaging around 15 cm long weighing up to a mega  $1\frac{1}{2}$  kg!

Lesson No	Lesson Name	Lesson Objectives
Lessons 1 to 3	Adding and Subtracting Mixed Numbers with Like Denominators	• Students will add and subtract mixed numbers with like denominators
	Finding Like Denominators	• Students will generate pairs of mixed numbers with like denominators. • Students will explain how to find like denominators for mixed numbers.
	Estimation with Mixed Numbers	• Students will use benchmark fractions and number sense of mixed numbers to estimate mentally.

## Lessons 1 to 3

- Adding and Subtracting Mixed Numbers with Like Denominators
- Finding Like Denominators
- Estimation with Mixed Numbers

### Remember

Mixed number  $\longleftrightarrow$  Improper fraction | Improper fraction  $\longleftrightarrow$  Mixed number

$$2\frac{3}{4} = \frac{11}{4} \quad | \quad \frac{18}{7} = 2\frac{4}{7} \quad \text{with } 18 \div 7 = 2R4$$

Mixed number  $\longleftrightarrow$  Equivalent mixed number

$$3\frac{2}{5} = 2\frac{7}{5} \quad \text{with } \text{Regroup 1 whole to } \frac{5}{5}$$



## Learn 1 Adding and subtracting mixed numbers with like denominators

### 1 Adding and subtracting using improper fractions

1. Rewrite each mixed number as an improper fraction.
2. Add / Subtract the numerators.

Example

$$2\frac{3}{5} + 3\frac{1}{5} = \frac{13}{5} + \frac{16}{5} = \frac{29}{5} = 5\frac{4}{5} \quad | \quad 7\frac{1}{4} - 5\frac{3}{4} = \frac{29}{4} - \frac{23}{4} = \frac{6}{4} = \frac{3}{2} = 1\frac{1}{2}$$

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## 2 Adding and subtracting by decomposing the mixed numbers and simplifying the answer

1. Add / Subtract the whole parts.
2. Add / Subtract the fraction parts.
3. Combine the two resulted parts.

### Note that

In some subtraction problems you need to regroup the minuend.

Example :

$$\begin{aligned} & 3\frac{2}{7} + 1\frac{3}{7} \\ &= (3+1) + (\frac{2}{7} + \frac{3}{7}) \\ &= 4\frac{5}{7} \end{aligned}$$

$$\begin{aligned} & 11\frac{1}{6} - 5\frac{5}{6} \\ &= 10\frac{7}{6} - 5\frac{5}{6} \\ &= (10-5) + (\frac{7}{6} - \frac{5}{6}) \\ &= 5\frac{2}{6} \\ &= 5\frac{1}{3} \end{aligned}$$

$$11\frac{1}{6} = 10\frac{7}{6}$$

"regrouping"

### Example 1

Evaluate each sum or difference, simplify if possible.

a.  $2\frac{1}{4} + 1\frac{1}{4}$

b.  $6\frac{3}{4} - 5\frac{1}{4}$

c.  $4\frac{5}{9} + 2\frac{7}{9}$

d.  $8\frac{1}{5} - 3\frac{4}{5}$

### Solution

a.  $2\frac{1}{4} + 1\frac{1}{4} = \frac{9}{4} + \frac{5}{4} = \frac{14}{4} = 3\frac{2}{4} = 3\frac{1}{2}$

b.  $6\frac{3}{4} - 5\frac{1}{4} = \frac{27}{4} - \frac{21}{4} = \frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2}$

c.  $4\frac{5}{9} + 2\frac{7}{9} = \frac{41}{9} + \frac{25}{9} = \frac{66}{9} = 7\frac{3}{9} = 7\frac{1}{3}$

d.  $8\frac{1}{5} - 3\frac{4}{5} = \frac{41}{5} - \frac{19}{5} = \frac{22}{5} = 4\frac{2}{5}$

### Another solution :

a.  $2\frac{1}{4} + 1\frac{1}{4} = (2+1) + (\frac{1}{4} + \frac{1}{4}) = 3\frac{2}{4} = 3\frac{1}{2}$

b.  $6\frac{3}{4} - 5\frac{1}{4} = (6-5) + (\frac{3}{4} - \frac{1}{4}) = 1\frac{2}{4} = 1\frac{1}{2}$

c.  $4\frac{5}{9} + 2\frac{7}{9} = (4+2) + (\frac{5}{9} + \frac{7}{9}) = 6\frac{12}{9} = 7\frac{3}{9} = 7\frac{1}{3}$

d.  $8\frac{1}{5} - 3\frac{4}{5} = 7\frac{6}{5} - 3\frac{4}{5} = (7-3) + (\frac{6}{5} - \frac{4}{5}) = 4\frac{2}{5}$

### Check your understanding

a.  $2\frac{1}{5} + 3\frac{3}{5}$

b.  $4\frac{2}{3} - 1\frac{1}{3}$

c.  $3\frac{3}{8} + 1\frac{5}{8}$

d.  $5\frac{2}{7} - 3\frac{5}{7}$

### Equations with fractions

- You can solve an equation with fractions in the same way you solve an equation with whole numbers : you get the variable alone on one side of the equal sign using properties of equality and inverse operations.

### Example 2

Evaluate each of the following equations.

a.  $3\frac{2}{5} + k = 6\frac{1}{5}$

b.  $7\frac{2}{3} - b = 5\frac{1}{3}$

### Solution

a.  $3\frac{2}{5} + k = 6\frac{1}{5} \Rightarrow$  Use inverse operation

$$k = 6\frac{1}{5} - 3\frac{2}{5} = \frac{31}{5} - \frac{17}{5} = \frac{14}{5} = 2\frac{4}{5}$$

b.  $7\frac{2}{3} - b = 5\frac{1}{3} \Rightarrow$  Use whole-part model

$$b = 7\frac{2}{3} - 5\frac{1}{3} = (7-5) + (\frac{2}{3} - \frac{1}{3}) = 2\frac{1}{3}$$

$$\begin{array}{r} 7\frac{2}{3} \\ - 5\frac{1}{3} \\ \hline \end{array}$$



## Learn 2 Finding like denominators

Mixed numbers with unlike denominators

Use LCM of denominators

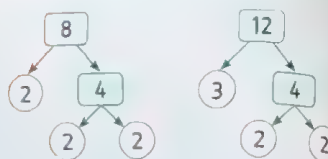
Mixed numbers with like denominator

Example:

$$2\frac{4}{8} \text{ and } 1\frac{9}{12}$$

$$\downarrow \quad \downarrow$$

$$2\frac{12}{24} \text{ and } 1\frac{18}{24}$$



$$8 = 2 \times 2 \times 2$$

$$12 = 2 \times 2 \times 3$$

$$\text{LCM} = 2 \times 2 \times 2 \times 3 = 24$$

### Note that

It is possible to put the two fractions in the simplest form before finding LCM of the two denominators as the following.

$$2\frac{4}{8} \text{ and } 1\frac{9}{12}$$

$$\downarrow \quad \downarrow$$

**Simplify**

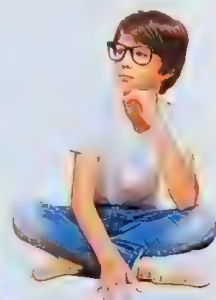
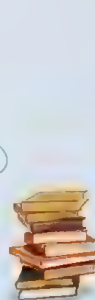
$$\downarrow \quad \downarrow$$

$$2\frac{1}{2} \text{ and } 1\frac{3}{4}$$

$$\downarrow \quad \downarrow$$

$$2\frac{2}{4} \text{ and } 1\frac{3}{4}$$

LCM of 2 and 4 is 4



### From the previous:

The two unlike denominators of fractions  $2\frac{4}{8}$  and  $1\frac{9}{12}$  can be rewrite with like

denominators in different forms such as:  $2\frac{12}{24}$  and  $1\frac{18}{24}$  or  $2\frac{2}{4}$  and  $1\frac{3}{4}$

## Example 3

Rewrite the given mixed numbers with like denominators in two different ways.

$$1\frac{3}{8} \text{ and } 3\frac{12}{15}$$

### Solution

First way:

$$1\frac{3}{8} \text{ and } 3\frac{12}{15}$$

$$\downarrow \quad \downarrow$$

$$1\frac{45}{120} \text{ and } 3\frac{96}{120}$$



$$8 = 2 \times 2 \times 2$$

$$15 = 3 \times 5$$

$$\text{LCM} = 2 \times 2 \times 2 \times 3 \times 5 = 120$$

Second way:

$$1\frac{3}{8} \text{ and } 3\frac{12}{15}$$

$$\downarrow \quad \downarrow$$

**Simplify**

$$\downarrow \quad \downarrow$$

$$1\frac{3}{8} \text{ and } 3\frac{4}{5}$$

$$\downarrow \quad \downarrow$$

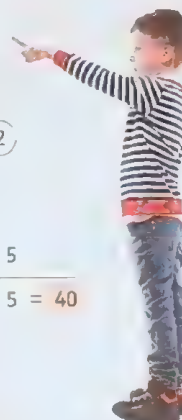
$$1\frac{15}{40} \text{ and } 3\frac{32}{40}$$



$$8 = 2 \times 2 \times 2$$

$$5 = 5$$

$$\text{LCM} = 2 \times 2 \times 2 \times 5 = 40$$



i.e.  $1\frac{3}{8}$  and  $3\frac{12}{15}$

Can be rewrite with like denominators as

$$1\frac{45}{120} \text{ and } 3\frac{96}{120}$$

or

$$1\frac{15}{40} \text{ and } 3\frac{32}{40}$$

**Check** your understanding

Rewrite  $3\frac{6}{18}$  and  $4\frac{18}{24}$  with like denominators in two different ways.

**Learn 3** Estimation with mixed numbers

**Remember**

In any fraction :

If the numerator is much less than half the denominator, the fraction is closer to 0

If the numerator is about half the denominator, the fraction is closer to  $\frac{1}{2}$

If the numerator is much more than half the denominator, the fraction is closer to 1

Example : each of  $\frac{1}{7}, \frac{2}{9}, \frac{3}{20}$  is closer to 0

Example : each of  $\frac{3}{8}, \frac{6}{10}, \frac{11}{20}$  is closer to  $\frac{1}{2}$

Example : each of  $\frac{9}{10}, \frac{14}{13}, \frac{6}{7}$  is closer to 1

**From the previous :**

- ▶ If  $9\frac{x}{7}$  is a little greater than  $9\frac{1}{2}$ , then  $x$  is estimated as  4  or  5 .
- ▶ If  $4\frac{k}{8}$  is almost 5, then  $k$  is estimated as  6 ,  7 ,  8 ,  9  or  10 .
- ▶ If  $8\frac{3}{n}$  is slightly less than  $8\frac{1}{2}$ , then  $n$  is estimated as  7  or  8 .

**Note that**

Answers may vary

**Example 4**

Estimate one possible value for  $x$  in each of the following.

- a.  $5\frac{x}{24}$  is slightly greater than  $5\frac{1}{2}$
- b.  $7\frac{8}{x}$  is a little greater than 7
- c.  $4\frac{x}{9}$  is about  $4\frac{3}{4}$
- d.  $17\frac{20}{x}$  is a little less than 18

**Solution**

- a. 13
- b. 100
- c. 7
- d. 21

**Example 5**

Estimate each sum or difference from the following.

- a.  $7\frac{4}{5} - 2\frac{1}{6}$
- b.  $8\frac{2}{3} + 1\frac{5}{6}$
- c.  $2\frac{1}{5} + 6\frac{11}{21}$
- d.  $9\frac{6}{7} - 5\frac{4}{9}$

**Solution**

- a.  $7\frac{4}{5} - 2\frac{1}{6}$  is estimated as  $8 - 2 = 6$
- b.  $8\frac{2}{3} + 1\frac{5}{6}$  is estimated as  $9 + 2 = 11$
- c.  $2\frac{1}{5} + 6\frac{11}{21}$  is estimated as  $2 + 6\frac{1}{2} = 8\frac{1}{2}$
- d.  $9\frac{6}{7} - 5\frac{4}{9}$  is estimated as  $10 - 5\frac{1}{2} = 4\frac{1}{2}$

**Check** your understanding

1. Estimate one value for  $n$ .

- a.  $7\frac{3}{n}$  is little less than  $7\frac{1}{2}$
- b.  $4\frac{n}{19}$  is about 5

2. Estimate.

- a.  $3\frac{1}{5} - 1\frac{9}{11}$
- b.  $8\frac{7}{8} + 7\frac{1}{6}$

# Exercise 5

on lessons 1 to 3

REMEMBER UNDERSTAND APPLY PROBLEM SOLVING

From the school book

- Adding and Subtracting Mixed Numbers with Like Denominators
- Finding Like Denominators
- Estimation with Mixed Numbers

1. Complete the chart by rewriting the given values in two other forms.

	Mixed Number	Improper Fraction Equivalent	Mixed Number Equivalent
a.	$3\frac{1}{3}$	$\frac{\quad}{\quad}$	$2\frac{\quad}{\quad}$
b.	$2\frac{5}{8}$	$\frac{\quad}{\quad}$	$1\frac{\quad}{\quad}$
c.	$\frac{\quad}{\quad}$	$\frac{28}{5}$	$3\frac{\quad}{\quad}$
d.	$4\frac{3}{4}$	$\frac{\quad}{\quad}$	$3\frac{\quad}{\quad}$
e.	$\frac{\quad}{\quad}$	$\frac{9}{2}$	$2\frac{\quad}{\quad}$
f.	$\frac{\quad}{\quad}$	$\frac{22}{4}$	$3\frac{\quad}{\quad}$

2. Evaluate each sum or difference. Simplify if possible.

a.  $1\frac{3}{5} + 3\frac{1}{5} = \quad$

b.  $2\frac{5}{6} + 2\frac{3}{6} = \quad$

c.  $7\frac{1}{6} + 1\frac{3}{6} = \quad$

d.  $4\frac{4}{9} + 1\frac{1}{9} = \quad$

e.  $8\frac{3}{7} - 8\frac{1}{7} = \quad$

f.  $1\frac{2}{3} + 3\frac{2}{3} = \quad$

g.  $3\frac{2}{5} - 1\frac{4}{5} = \quad$

h.  $5\frac{1}{4} - 2\frac{3}{4} = \quad$

i.  $2\frac{3}{4} + 5\frac{1}{4} = \quad$

j.  $5\frac{2}{7} - 3\frac{4}{7} = \quad$

k.  $8\frac{3}{4} + 2\frac{3}{4} = \quad$

l.  $4\frac{3}{11} - 1\frac{7}{11} = \quad$

m.  $2\frac{1}{4} + 2\frac{3}{4} = \quad$

n.  $4\frac{5}{6} - 2\frac{1}{6} = \quad$

3. Choose from the given values to solve each.

$\frac{1}{3}$     $\frac{2}{3}$     $1\frac{1}{3}$     $1\frac{2}{3}$     $5\frac{1}{4}$     $5\frac{2}{4}$     $5\frac{3}{4}$   
 $2\frac{2}{5}$     $2\frac{3}{5}$     $2\frac{4}{5}$     $\frac{5}{8}$     $1\frac{3}{8}$     $1\frac{5}{8}$     $\frac{1}{5}$

a.  $3\frac{1}{5} + b = 5\frac{3}{5}$     $b = \quad$    b.  $c + 4\frac{2}{3} = 5\frac{1}{3}$     $c = \quad$

c.  $2\frac{4}{8} - d = 1\frac{1}{8}$     $d = \quad$    d.  $f + 1\frac{3}{4} = 7\frac{1}{4}$     $f = \quad$

e.  $g - \frac{7}{8} = \frac{6}{8}$     $g = \quad$    f.  $2\frac{2}{3} - h = 1$     $h = \quad$

g.  $j + 3\frac{3}{4} = 9\frac{2}{4}$     $j = \quad$    h.  $8\frac{1}{5} - k = 5\frac{3}{5}$     $k = \quad$

i.  $4 - p = 1\frac{1}{5}$     $p = \quad$    j.  $r + 6\frac{5}{8} = 7\frac{2}{8}$     $r = \quad$

4. Rewrite the given two mixed numbers with like denominators in two different ways.

a.  $3\frac{1}{4}$  and  $1\frac{6}{30}$

• First way:

$3\frac{1}{4}$  and  $1\frac{6}{30}$   
 $\frac{\quad}{\quad}$  and  $\frac{\quad}{\quad}$



$4 = 2 \times \quad$

$30 = \quad$

LCM =  $\quad$

• Second way:

b.  $3\frac{1}{4}$  and  $1\frac{6}{30}$

$\frac{\quad}{4}$  and  $\frac{\quad}{5}$   
 $\frac{\quad}{20}$  and  $\frac{\quad}{20}$

in the simplest form

LCM of 4 and 5 is 20



5. Rewrite the given mixed numbers with like denominators in two different ways.

First Rewrite

Second Rewrite

- a.  $1\frac{3}{4}$  and  $1\frac{6}{15}$  A. \_\_\_\_\_ and \_\_\_\_\_ B. \_\_\_\_\_ and \_\_\_\_\_
- b.  $3\frac{6}{8}$  and  $2\frac{8}{12}$  A. \_\_\_\_\_ and \_\_\_\_\_ B. \_\_\_\_\_ and \_\_\_\_\_
- c.  $2\frac{9}{18}$  and  $2\frac{14}{24}$  A. \_\_\_\_\_ and \_\_\_\_\_ B. \_\_\_\_\_ and \_\_\_\_\_
- d.  $3\frac{12}{16}$  and  $1\frac{15}{24}$  A. \_\_\_\_\_ and \_\_\_\_\_ B. \_\_\_\_\_ and \_\_\_\_\_
- e.  $10\frac{5}{6}$  and  $5\frac{15}{27}$  A. \_\_\_\_\_ and \_\_\_\_\_ B. \_\_\_\_\_ and \_\_\_\_\_

6. Complete the following table using the like denominators.

	Two mixed numbers	Like denominators	Rewrite in like denominators
a.	$3\frac{50}{100}, 4\frac{12}{30}$	10	_____, _____
b.	$5\frac{8}{40}, 1\frac{9}{15}$	5	_____, _____
c.	$2\frac{2}{3}, 8\frac{12}{18}$	3	_____, _____
d.	$4\frac{15}{25}, 3\frac{6}{15}$	5	_____, _____
e.	$1\frac{21}{24}, 4\frac{25}{40}$	8	_____, _____

7. Join each fraction and mixed number to its suitable place on the number line.

$\frac{9}{12}$     $\frac{3}{8}$     $3\frac{8}{9}$     $1\frac{3}{7}$     $3\frac{2}{10}$     $2\frac{1}{12}$



8. Use number sense and estimation to complete the mixed numbers.

- a.  $7\frac{a}{8}$  is a little greater than  $7\frac{1}{2}$  Estimate for a: \_\_\_\_\_
- b.  $3\frac{b}{9}$  is almost 4 Estimate for b: \_\_\_\_\_
- c.  $10\frac{3}{c}$  is slightly less than  $10\frac{1}{2}$  Estimate for c: \_\_\_\_\_
- d.  $1\frac{8}{d}$  is nearly  $1\frac{1}{2}$  Estimate for d: \_\_\_\_\_
- e.  $2\frac{10}{f}$  is slightly greater than  $2\frac{1}{2}$  Estimate for f: \_\_\_\_\_
- f.  $5\frac{20}{g}$  is a little less than 6 Estimate for g: \_\_\_\_\_
- g.  $4\frac{h}{54}$  is slightly greater than  $4\frac{1}{2}$  Estimate for h: \_\_\_\_\_
- h.  $2\frac{10}{j}$  is a little greater than 2 Estimate for j: \_\_\_\_\_
- i.  $3\frac{k}{23}$  is about  $3\frac{3}{4}$  Estimate for k: \_\_\_\_\_
- j.  $3\frac{p}{29}$  is about  $3\frac{3}{4}$  Estimate for p: \_\_\_\_\_

9. Using estimation to add and subtract. Estimate each sum or difference.

- a.  $6\frac{3}{4} - 2\frac{1}{5}$    b.  $4\frac{2}{3} + 3\frac{5}{6}$
- c.  $5\frac{1}{6} + 4\frac{8}{9}$    d.  $2\frac{4}{9} - \frac{11}{20}$
- e.  $12\frac{3}{7} + 3\frac{5}{11}$    f.  $2\frac{1}{5} + 3\frac{10}{21}$
- g.  $10\frac{7}{8} - 5\frac{4}{9}$    h.  $4\frac{3}{5} - 1\frac{7}{12}$
- i.  $3\frac{21}{24} - 2\frac{1}{3}$    j.  $6\frac{3}{8} + 1\frac{1}{2}$
- k.  $7\frac{2}{11} - 3\frac{12}{100}$    l.  $1\frac{5}{11} + 2\frac{7}{8}$
- m.  $9\frac{6}{11} + 2\frac{3}{100}$    n.  $7\frac{5}{14} - 3\frac{19}{34}$
- o.  $4\frac{1}{10} + 5\frac{6}{13}$    p.  $6\frac{3}{7} - 4\frac{2}{75}$

10. Read the problem. Then, explain how you would regroup quantities to solve the problem.

This summer, Nagi and his brother helped harvest cotton. There were 10 square meters of cotton that needed to be harvested. Nagi and his brother each harvested  $3\frac{3}{4}$  m<sup>2</sup> of cotton.

How many square meters of cotton were left?

11. Fady is writing  $\frac{16}{24}$  and  $\frac{3}{5}$  with like denominators. He is concerned that the denominator of the new fractions will be very large and that he will make a mistake rewriting the fractions.

Identify the missing values to rewrite each fraction with 120 as the denominator.

1.  $\frac{16}{24} = \frac{?}{120}$

2.  $\frac{3}{5} = \frac{?}{120}$

3. Is there a denominator less than 120 that can be used? Explain your reasoning.

12. Read the problem. Then, explain one way to rewrite the mixed numbers with like denominators using equivalent fractions.

Egyptian cotton is popular because the fibers are long, making Egyptian cotton smoother and silkier than other cotton fabrics. Egyptian cotton fibers usually range in length from about 3 to 5 centimeters. There fibers are first spun into thread and then thread is woven into fabric. Warda measured 3 pieces of Egyptian cotton fabric in meters.

$5\frac{16}{20}$  m

$3\frac{18}{45}$  m

$3\frac{5}{25}$  m

How would you rewrite the mixed numbers with like denominators?

13. Dalia has  $2\frac{1}{2}$  square meters of land on which she will plant cotton or sugarcane. She wants to plant on as much of the land as possible without wasting too much seed. Dalia has enough cotton seed to cover  $2\frac{3}{4}$  m<sup>2</sup> of land. She has enough sugarcane seed to cover  $2\frac{3}{8}$  m<sup>2</sup> of land.

Which crop should she plant? Why?

## Multiple Choice Questions

Choose the correct answer.

1. If  $3\frac{2}{a}$  is estimated as 3, then a can equal

A. 2

B. 1

C. 4

D. 15

2.  $4\frac{3}{7} + 1\frac{5}{7} =$

A.  $5\frac{1}{7}$

B.  $6\frac{1}{7}$

C.  $5\frac{8}{14}$

D.  $6\frac{2}{7}$

3.  $5\frac{5}{8} - 3\frac{2}{8} =$

A.  $8\frac{7}{8}$

B.  $3\frac{3}{8}$

C.  $2\frac{1}{4}$

D.  $2\frac{3}{8}$

4.  $4\frac{3}{5} + k = 6\frac{2}{5}$ , then k =

A.  $1\frac{4}{5}$

B. 11

C.  $2\frac{1}{5}$

D.  $1\frac{3}{5}$

5. Two fractions  $2\frac{5}{8}$  and  $1\frac{3}{4}$  with like denominators are

A.  $2\frac{5}{16}$  and  $1\frac{3}{16}$

B.  $1\frac{5}{8}$  and  $2\frac{6}{8}$

C.  $2\frac{5}{8}$  and  $1\frac{3}{8}$

D.  $2\frac{5}{8}$  and  $1\frac{6}{8}$

6.  $8\frac{3}{5} + 1\frac{1}{12}$  can be estimated as

A. 9

B.  $9\frac{1}{2}$

C. 10

D.  $8\frac{1}{2}$

7. If  $5\frac{n}{18}$  is about 5, then n may be

A. 8

B. 17

C. 2

D. 12

8.  $9\frac{4}{7} - 9\frac{1}{7} =$

A. 0

B.  $9\frac{3}{7}$

C.  $\frac{3}{7}$

D.  $1\frac{2}{7}$

9.  $\frac{19}{5}$  is equivalent to

A.  $3\frac{3}{5}$

B.  $4\frac{1}{5}$

C.  $3\frac{5}{5}$

D.  $3\frac{4}{5}$

10.  $3\frac{4}{7}$  can be regrouped as

A. 3

B. 4

C.  $2\frac{11}{7}$

D.  $2\frac{4}{7}$

## Concept

# 2

## Adding and Subtracting Mixed Numbers with Unlike Denominators

Lessons  
4 to 6



### Did You Know?!

The average birth weight of a full-term male baby is  $3\frac{3}{10}$  kg.

The average of birth weight of a full-term female is  $3\frac{2}{10}$  kg.

What is the difference between the two weights?

Lesson No.	Lesson Name	Lesson Objectives
Lessons 4 to 6	Using Models to Add and Subtract Mixed Numbers	• Students will use models to represent addition and subtraction of mixed numbers with unlike denominators.
	Adding and Subtracting Mixed Numbers, Part 1	• Students will add and subtract fractions and mixed numbers with unlike denominators. • Students will use estimation to assess the reasonableness of their answers
	Adding and Subtracting Mixed Numbers, Part 2	• Students will add and subtract fractions and mixed numbers with unlike denominators.
Lessons 7 & 8	Story Problems with Mixed Numbers	• Students will solve story problems involving addition and subtraction of fractions and mixed numbers.
	More Story Problems with Mixed Numbers	• Students will solve story problems involving addition and subtraction of fractions and mixed numbers.

- Using Models to Add and Subtract Mixed Numbers
- Adding and Subtracting Mixed Numbers, Part 1
- Adding and Subtracting Mixed Numbers, Part 2

### Learn 1 Using models to add and subtract mixed numbers



To add or subtract two mixed numbers using models



① Model each mixed number using model area

② Divide the two fraction parts into the same number of rectangles

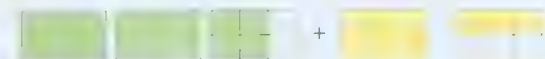
③ Add or subtract and regroup the result

Add  $2\frac{2}{5} + 1\frac{1}{2}$

#### Step 1: Modeling



#### Step 2: Dividing



#### Step 3: Adding



# Subtract $2\frac{1}{3} - 1\frac{1}{6}$

## Step 1: Modeling



## Step 2: Dividing



## Step 3: Subtracting



## Check your understanding

Use an area model to find.

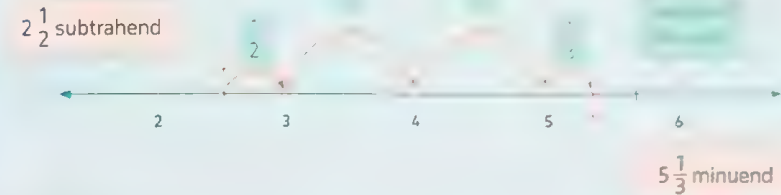
a.  $1\frac{4}{5} + 2\frac{1}{2}$

b.  $3\frac{3}{8} - 2\frac{3}{4}$

## Using number line to subtract mixed numbers

To subtract  $5\frac{1}{3} - 2\frac{1}{2}$  using number line

- 1 Draw number line
- 2 Start at  $2\frac{1}{2}$ , mark jumps to 3, 4, 5 and  $5\frac{1}{3}$
- 3 Add lengths of the jumps to find the difference



The difference =  $\frac{1}{2} + 1 + 1 + \frac{1}{3}$   
 $= \frac{3}{6} + 2 + \frac{2}{6} = 2\frac{5}{6}$

## Check your understanding

Use number line to find.

a.  $4\frac{3}{4} - 2\frac{5}{6}$

b.  $8\frac{1}{5} - 6\frac{3}{4}$

## Learn 2 Adding and subtracting mixed numbers

There are two methods to add or subtract two mixed numbers with unlike denominators

- 1 By rewriting the mixed numbers as improper fractions.
- 2 By decomposing the mixed numbers.

### Example 1

Find. 1  $7\frac{3}{5} + 2\frac{1}{4}$

2  $4\frac{1}{3} - 2\frac{5}{6}$

### Solution

1 Using improper fractions	Using decomposing the mixed numbers
$7\frac{3}{5} + 2\frac{1}{4}$	$7\frac{3}{5} + 2\frac{1}{4}$
$= \frac{38}{5} + \frac{9}{4}$	$= [7+2] + [\frac{3}{5} + \frac{1}{4}]$
$= \frac{152}{20} + \frac{45}{20}$	$= 9 + [\frac{12}{20} + \frac{5}{20}]$
$= \frac{197}{20} = 9\frac{17}{20}$	$= 9 + \frac{17}{20} = 9\frac{17}{20}$

2 Using improper fractions	Using decomposing the mixed number
$4\frac{1}{3} - 2\frac{5}{6}$	$4\frac{1}{3} - 2\frac{5}{6}$
$= \frac{13}{3} - \frac{17}{6}$	$= 3\frac{4}{3} - 2\frac{5}{6}$
$= \frac{26}{6} - \frac{17}{6}$	$= [3-2] + [\frac{4}{3} - \frac{5}{6}]$
$= \frac{9}{6} = \frac{3}{2} = 1\frac{1}{2}$	$= 1 + [\frac{8}{6} - \frac{5}{6}]$
	$= 1 + \frac{3}{6} = 1\frac{1}{2}$

**Notice**  
Regroup when the fraction of minuend is less than the fraction of subtrahend.

## check your understanding

Evaluate each sum or difference.

a.  $12\frac{3}{4} + 3\frac{6}{12}$

b.  $7\frac{5}{14} - 3\frac{2}{7}$

c.  $5\frac{4}{5} + 4\frac{5}{6}$

d.  $11\frac{2}{9} - 3\frac{3}{4}$

## Learn 3 Adding and subtracting mixed numbers by adjusting the mixed numbers

You can use "Give and take strategy" to make addition and subtraction easier (for example using compatible numbers, making 10 and so on) as the following.

$4\frac{7}{10} + 3\frac{2}{5}$ $= 4\frac{7}{10} + \frac{3}{10} + 3\frac{2}{5} - \frac{3}{10}$ $= 5 + 3 + \frac{4}{10} - \frac{3}{10} = 8\frac{1}{10}$	<p>Give and take</p> $5\frac{3}{7} - 2\frac{4}{7}$ $= [5\frac{3}{7} + \frac{3}{7}] - [2\frac{4}{7} + \frac{3}{7}]$ $= 5\frac{6}{7} - 3 = 2\frac{6}{7}$
---	--

## check your understanding

Solve each equation by adjusting the mixed numbers.

a.  $1\frac{3}{7} + 3\frac{2}{7} = 2 +$

b.  $4\frac{3}{8} + \frac{1}{4} - 5 +$

c.  $5\frac{2}{7} - 2\frac{4}{7} = - 3$

d.  $5\frac{1}{8} - 2\frac{1}{4} = - 3$



## Example 2

Find the missing number using any strategy, simplify if possible.

a.  $k + 3\frac{1}{4} = 5\frac{5}{6}$

c.  $a + 7\frac{3}{5} = 10\frac{7}{10}$

**Solution**

a.  $k + 3\frac{1}{4} = 5\frac{5}{6}$

$k = 5\frac{5}{6} - 3\frac{1}{4}$

$k = (5 - 3) + (\frac{5}{6} - \frac{1}{4})$

$k = 2 + (\frac{10}{12} - \frac{3}{12})$

$k = 2 + \frac{7}{12} = 2\frac{7}{12}$

c.  $a + 7\frac{3}{5} = 10\frac{7}{10}$

$a = 10\frac{7}{10} - 7\frac{3}{5}$

$a = (10 - 7) + (\frac{7}{10} - \frac{3}{5})$

$a = 3 + (\frac{7}{10} - \frac{6}{10})$

$a = 3 + \frac{1}{10}$

$a = 3\frac{1}{10}$

b.  $9\frac{9}{20} - c = 4\frac{3}{20}$

d.  $h - 4\frac{7}{8} = 4\frac{37}{40}$

b.  $9\frac{9}{20} - c = 4\frac{3}{20}$

$c = 9\frac{9}{20} - 4\frac{3}{20}$

$c = 5\frac{6}{20}$

$c = 5\frac{3}{10}$

	$9\frac{9}{20}$
c	$4\frac{3}{20}$

d.  $h - 4\frac{7}{8} = 4\frac{37}{40}$

$h = 4\frac{37}{40} + 4\frac{7}{8}$

$h = (4 + 4) + (\frac{37}{40} + \frac{7}{8})$

$h = 8 + (\frac{37}{40} + \frac{35}{40})$

$h = 8 + \frac{72}{40}$

$h = 8 + 1\frac{32}{40}$

$h = 9\frac{32}{40}$

$h = 9\frac{4}{5}$



**Check** your understanding

Find the missing number using any strategy.

a.  $x + 1\frac{3}{5} = 4\frac{1}{2}$

b.  $y - 2\frac{2}{7} = 1\frac{3}{8}$

## Exercise 6

on lessons 4 to 6

REMEMBER

UNDERSTAND

APPLY

PROBLEM SOLVING

From the school book

- Using Models to Add and Subtract Mixed Numbers
- Adding and Subtracting Mixed Numbers, Part 1
- Adding and Subtracting Mixed Numbers, Part 2

1. Use area models to add.

a.  $1\frac{1}{2} + 2\frac{1}{3} =$

		+			
--	--	---	--	--	--

b.  $3\frac{2}{5} + 1\frac{7}{10} =$

				+		
--	--	--	--	---	--	--

c.  $2\frac{3}{4} + 1\frac{2}{3} =$

			+		
--	--	--	---	--	--

d.  $1\frac{4}{7} + 2\frac{1}{2} =$

		+			
--	--	---	--	--	--

2. Use an area model to find each sum.

a.  $2\frac{2}{5} + 1\frac{1}{2} =$

b.  $3\frac{2}{3} + 2\frac{4}{5} =$

c.  $4\frac{2}{3} + 2\frac{3}{4} =$

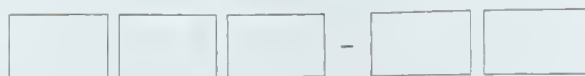
d.  $2\frac{3}{8} + 5\frac{3}{4} = \underline{\hspace{2cm}}$

e.  $2\frac{5}{12} + 1\frac{1}{6} = \underline{\hspace{2cm}}$

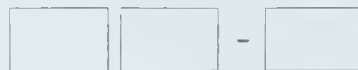
f.  $2\frac{3}{4} + 1\frac{4}{10} = \underline{\hspace{2cm}}$

3. Use area models to subtract.

a.  $2\frac{5}{6} - 1\frac{2}{3} = \underline{\hspace{2cm}}$



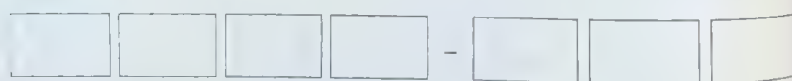
b.  $1\frac{3}{4} - \frac{1}{2} = \underline{\hspace{2cm}}$



c.  $2\frac{3}{5} - 1\frac{1}{3} = \underline{\hspace{2cm}}$



d.  $3\frac{1}{2} - 2\frac{2}{3} = \underline{\hspace{2cm}}$



4. Use an area model to find each difference.

a.  $3\frac{1}{2} - 1\frac{2}{5} = \underline{\hspace{2cm}}$

b.  $4\frac{1}{6} - 2\frac{5}{12} = \underline{\hspace{2cm}}$

c.  $1\frac{2}{3} - \frac{1}{2} = \underline{\hspace{2cm}}$

d.  $4\frac{5}{8} - 3\frac{1}{6} = \underline{\hspace{2cm}}$

5. Use a number line to find the difference.

a.  $6\frac{1}{5} - 4\frac{3}{4} = \underline{\hspace{2cm}}$



b.  $9\frac{2}{3} - 6\frac{1}{2} = \underline{\hspace{2cm}}$



c.  $7\frac{5}{6} - 4\frac{1}{4} = \underline{\hspace{2cm}}$



d.  $8\frac{3}{4} - 5\frac{1}{3} = \underline{\hspace{2cm}}$



6. Use a number line to find the difference.

a.  $5\frac{1}{4} - 3\frac{1}{6} = \underline{\hspace{2cm}}$



12. Solve each equation by adjusting the mixed numbers.

a.  $3\frac{7}{8} + \frac{1}{4} = 4 + \underline{\hspace{2cm}}$

c.  $7\frac{5}{7} - 5\frac{6}{7} = \underline{\hspace{2cm}} - 6$

b.  $1\frac{5}{6} + 3\frac{1}{3} = 2 + \underline{\hspace{2cm}}$

d.  $6\frac{1}{8} - 3\frac{3}{4} = \underline{\hspace{2cm}} - 4$

13. Find the missing number using any strategy. Simplify if possible.

a.  $a + 5\frac{5}{6} = 9\frac{1}{12}$ ,  $a = \underline{\hspace{2cm}}$

b.  $8\frac{7}{10} - b = 4\frac{9}{20}$ ,  $b = \underline{\hspace{2cm}}$

c.  $9\frac{5}{20} - c = 4\frac{19}{20}$ ,  $c = \underline{\hspace{2cm}}$

d.  $6\frac{7}{15} + d = 13\frac{3}{10}$ ,  $d = \underline{\hspace{2cm}}$

e.  $f + 9\frac{1}{4} = 12\frac{15}{16}$ ,  $f = \underline{\hspace{2cm}}$

f.  $g - 1\frac{3}{4} = 7\frac{3}{44}$ ,  $g = \underline{\hspace{2cm}}$

g.  $4\frac{12}{18} + h = 11$ ,  $h = \underline{\hspace{2cm}}$

h.  $j - 4\frac{7}{8} = 4\frac{37}{40}$ ,  $j = \underline{\hspace{2cm}}$



14. Read the problem and analyze the work submitted by one student.

Wael collected  $4\frac{1}{4}$  kilograms of dates.

He gave  $2\frac{3}{5}$  kg to a friend.

He wants to know how many

kilograms are left.

Is Wael's response correct? Explain why or why not.

Wael's work:

$$\begin{array}{r} 4\frac{1}{4} \quad 4\frac{5}{20} \\ -2\frac{3}{5} \quad -2\frac{12}{20} \\ \hline 2\frac{7}{20} \end{array}$$

15. Heba and her neighbour, Ezz, enjoy having flowerpots in their yards. Heba's pot of cornflowers has a mass of  $3\frac{1}{4}$  kilograms and her pot of poppies has a mass of  $1\frac{9}{10}$  kg. Ezz's pot of cornflowers has a mass of  $3\frac{1}{2}$  kg and her pot of poppies has a mass of  $1\frac{3}{4}$  kg. Whose pots have a greater mass? By how much?

A student wrote this solution to the problem about Heba and Ezz. Is the student's work correct? Explain why or why not.

Heba's pots have a mass of  $4\frac{10}{14}$  kg and Ezz's pots have a mass of  $4\frac{4}{8}$  kg. Heba's pots have a greater mass by  $\frac{6}{8}$  kg.

## Multiple Choice Questions

Choose the correct answer.

1.  $5\frac{1}{2} + 3\frac{1}{5} = \underline{\hspace{2cm}}$

A.  $8\frac{2}{7}$

B.  $8\frac{7}{10}$

C.  $8\frac{1}{2}$

D.  $8\frac{2}{5}$

2.  $1\frac{4}{5} - 1\frac{1}{20} = \underline{\hspace{2cm}}$

A.  $\frac{7}{20}$

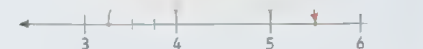
B.  $\frac{4}{3}$

C.  $\frac{3}{4}$

D.  $1\frac{1}{5}$

3. The number line is

used to solve the problem



A.  $3\frac{1}{4} + 5\frac{1}{2}$

B.  $3\frac{1}{4} - 2\frac{1}{2}$

C.  $5\frac{1}{2} - 3\frac{1}{4}$

D.  $5\frac{1}{4} + 3\frac{1}{2}$

4.  $2\frac{1}{3} + 1\frac{2}{5}$  can be rewrite as  $\underline{\hspace{2cm}}$

A.  $\frac{6}{3} + \frac{5}{5}$

B.  $\frac{7}{3} + \frac{5}{7}$

C.  $[2+1] + [\frac{1}{3} + \frac{2}{5}]$

D.  $3\frac{1}{2} + 5\frac{1}{2}$

5.  $4\frac{2}{3} + 1\frac{2}{5} = 5 + 1\frac{2}{5} - \underline{\hspace{2cm}}$

A.  $\frac{2}{3}$

B.  $\frac{2}{5}$

C.  $\frac{3}{5}$

D.  $\frac{1}{3}$

6.  $7\frac{3}{4} - 3\frac{5}{6} = 7 + \frac{3}{4} + \underline{\hspace{2cm}} - 4$

A.  $\frac{1}{6}$

B.  $\frac{5}{6}$

C.  $\frac{3}{4}$

D.  $\frac{1}{4}$

7.  $X + 4\frac{1}{4} = 5\frac{1}{2}$ , then  $X = \underline{\hspace{2cm}}$

A.  $\frac{1}{2}$

B.  $\frac{1}{4}$

C.  $1\frac{1}{2}$

D.  $1\frac{1}{4}$

8.  $3\frac{3}{8} - 2\frac{1}{4} = \underline{\hspace{2cm}}$

A.  $1\frac{1}{8}$

B.  $1\frac{1}{4}$

C.  $2\frac{1}{4}$

D.  $\frac{1}{8}$

9. Which of the following is incorrect?

A.  $3\frac{3}{4} = 2\frac{7}{4}$

B.  $2\frac{5}{8} = \frac{21}{8}$

C.  $\frac{5}{3} = 1\frac{2}{3}$

D.  $1\frac{3}{4} - 1\frac{1}{2} = 1\frac{1}{4}$

10. Which of the following is correct?

A.  $1\frac{1}{2} + 2\frac{3}{4} = [1+2] - [\frac{1}{2} + \frac{3}{4}]$

B.  $7\frac{3}{5} = 6\frac{4}{5}$

C.  $5\frac{1}{3} - 2\frac{2}{3} = 4\frac{4}{3} - 2\frac{2}{3}$

D.  $\frac{2}{3} + \frac{1}{4} = \frac{3}{7}$

# Lessons 7 & 8

- Story Problems with Mixed Numbers
- More Story Problems with Mixed Numbers

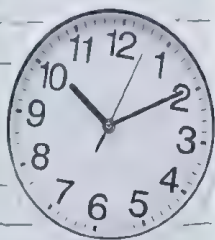
## Learn 1 Fraction of units of time



### Remember

one year = 12 months  
one day = 24 hours

one hour = 60 minutes  
one minute = 60 seconds



How many months are there in fraction of year?

How many hours are there in fraction of day?

- Write equivalent fraction of denominator 12 to the given fraction, then the new numerator is the answer.

- Write equivalent fraction of denominator 24 to the given fraction, then the new numerator is the answer.

$$\frac{1}{2} \text{ year} = \frac{6}{12} \text{ year} = 6 \text{ months}$$

$$\frac{1}{4} \text{ day} = \frac{6}{24} \text{ day} = 6 \text{ hours}$$

$$\frac{2}{3} \text{ year} = \frac{8}{12} \text{ year} = 8 \text{ months}$$

$$\frac{3}{8} \text{ day} = \frac{9}{24} \text{ day} = 9 \text{ hours}$$

How many minutes are there in fraction of hour?

How many seconds are there in fraction of minute?

- Write equivalent fraction of denominator 60 to the given fraction, then the new numerator is the answer.

- Write equivalent fraction of denominator 60 to the given fraction, then the new numerator is the answer.

$$\frac{1}{3} \text{ hour} = \frac{20}{60} \text{ hour} = 20 \text{ minutes}$$

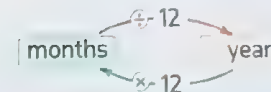
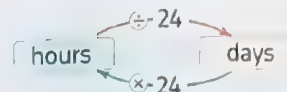
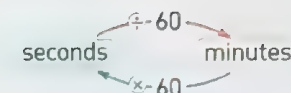
$$\frac{3}{10} \text{ minute} = \frac{18}{60} \text{ minute} = 18 \text{ seconds}$$

$$\frac{3}{4} \text{ hour} = \frac{45}{60} \text{ hour} = 45 \text{ minutes}$$

$$\frac{5}{6} \text{ minute} = \frac{50}{60} \text{ minute} = 50 \text{ seconds}$$



### Remember



Example:

$$80 \text{ minutes} = [80 \div 60] \text{ hours} = \frac{80}{60} \text{ hours} = 1\frac{1}{3} \text{ hour}$$

$$36 \text{ hours} = [36 \div 24] \text{ day} = \frac{36}{24} \text{ day} = 1\frac{1}{2} \text{ day}$$

$$4 \text{ hours} = [4 \times 60] \text{ minutes} = 240 \text{ minutes}$$

$$5 \text{ years} = [5 \times 12] \text{ months} = 60 \text{ months}$$

## Example 1

Find a and b in each of the following.

- $3\frac{1}{4}$  hours = a hours and b minutes
- $5\frac{1}{3}$  days = a days and b hours
- 100 seconds = a minutes

## Solution

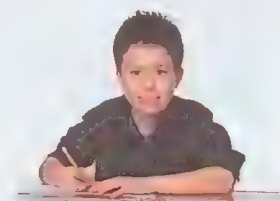
$$3\frac{1}{4} \text{ hours} = 3 \text{ hours and } \frac{15}{60} \text{ hour} \\ = 3 \text{ hours and } 15 \text{ minutes}$$

$$a = 3, b = 15$$

$$5\frac{1}{3} \text{ days} = 5 \text{ days and } \frac{8}{24} \text{ day} \\ = 5 \text{ days and } 8 \text{ hour}$$

$$a = 5, b = 8$$

$$100 \text{ seconds} = \frac{100}{60} \text{ minutes} = 1\frac{2}{3} \text{ minute}$$



## Example 2

Samer studied Math for  $1\frac{1}{3}$  hour and science for 90 minutes.

How long is the studying time? Give your answer both as a mixed number and in hours and minutes.

### Solution

$$\begin{aligned}\text{Time of studying science} &= 90 \text{ minutes} = \frac{90}{60} \text{ hours} \\ &= 1\frac{1}{2} \text{ hours}\end{aligned}$$

$$\begin{aligned}\text{The total studying time} &= 1\frac{1}{3} + 1\frac{1}{2} = (1+1) + (\frac{1}{3} + \frac{1}{2}) \\ &= 2 + (\frac{2}{6} + \frac{3}{6}) = 2\frac{5}{6} \text{ hours} \\ &= 2 \text{ hours and } \frac{50}{60} \text{ hours} \\ &= 2 \text{ hours and 50 minutes}\end{aligned}$$



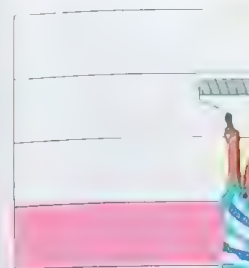
### Check your understanding

Complete.

- $5\frac{2}{3}$  minutes = \_\_\_\_\_ minutes and \_\_\_\_\_ seconds
- $6\frac{3}{5}$  hours = \_\_\_\_\_ hours and \_\_\_\_\_ minutes
- $3\frac{1}{2}$  years = \_\_\_\_\_ years and \_\_\_\_\_ months
- 75 seconds = \_\_\_\_\_ minute

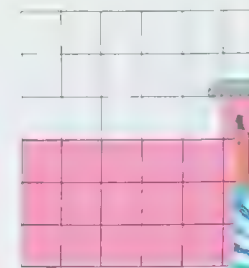
## Learn 2 More story problems with mixed numbers

Nader is painting a wall. What part is paint and what is left in each of the following?



Painted:  $\frac{1}{4}$  of the wall

Left:  $\frac{3}{4}$  of the wall



Painted:  $\frac{19}{36}$  of the wall

Left:  $\frac{17}{36}$  of the wall

## Example 3

Sally bought 4 identical tarts for her birthday party, she cut each tart differently. After the party was over, she noticed there was some pieces left in each tart. There was left  $\frac{3}{8}$  of first tart,  $\frac{5}{12}$  of second tart,  $\frac{5}{24}$  of third tart and  $\frac{1}{3}$  of the fourth tart.

- How much tart was eaten at the party?
- Which tart had least left part?
- Can the remaining pieces form a whole tart? Why?



### Solution

1 <sup>st</sup> tart	2 <sup>nd</sup> tart	3 <sup>rd</sup> tart	4 <sup>th</sup> tart
left : $\frac{3}{8}$	left : $\frac{5}{12}$	left : $\frac{5}{24}$	left : $\frac{1}{3}$
eaten : $\frac{5}{8}$	eaten : $\frac{7}{12}$	eaten : $\frac{19}{24}$	eaten : $\frac{2}{3}$

a. The eaten tarts =  $\frac{5}{8} + \frac{7}{12} + \frac{9}{24} + \frac{2}{3}$

$$= \frac{15}{24} + \frac{14}{24} + \frac{19}{24} + \frac{16}{24} = \frac{64}{24} = 2\frac{16}{24} = 2\frac{2}{3}$$

b. The left parts respectively  $\left(\frac{3}{8}\right), \left(\frac{5}{12}\right), \left(\frac{5}{24}\right), \left(\frac{1}{3}\right)$   
 $\left(\frac{9}{24}\right), \left(\frac{10}{24}\right), \left(\frac{5}{24}\right), \left(\frac{8}{24}\right)$

, then the 3<sup>rd</sup> tart has the least fraction left.

c. Remaining parts can't form whole tart because

$$\frac{9}{24} + \frac{10}{24} + \frac{5}{24} + \frac{8}{24} = \frac{32}{24} = 1\frac{8}{24} = 1\frac{1}{3} \text{ [mixed number]}$$

### Check your understanding

Zeiad walked  $1\frac{3}{4}$  km, Ahmed walked  $\frac{1}{5}$  km more than Zeiad and Ramy walked  $\frac{3}{10}$  km less than Ahmed.

How many km Ramy walked ?



## Exercise

### 7

on lessons 7&8

REMEMBER

UNDERSTAND

APPLY

PROBLEM SOLVING

From the school book

#### 1. Complete.

a.  $\frac{3}{4}$  hour = \_\_\_\_\_ minutes

b.  $\frac{2}{3}$  minute = \_\_\_\_\_ seconds

c.  $\frac{1}{6}$  day = \_\_\_\_\_ hours

d.  $\frac{4}{5}$  hour = \_\_\_\_\_ minutes

e.  $\frac{3}{4}$  year = \_\_\_\_\_ months

f.  $2\frac{1}{3}$  hours = \_\_\_\_\_ hours and \_\_\_\_\_ minutes

g.  $7\frac{1}{10}$  minutes = \_\_\_\_\_ minutes and \_\_\_\_\_ seconds

h.  $2\frac{3}{5}$  minutes = \_\_\_\_\_ minutes and \_\_\_\_\_ seconds

i.  $4\frac{3}{4}$  hours = \_\_\_\_\_ hours and \_\_\_\_\_ minutes

j.  $6\frac{1}{2}$  years = \_\_\_\_\_ years and \_\_\_\_\_ months

k.  $1\frac{1}{2}$  year = [ \_\_\_\_\_ + \_\_\_\_\_ ] months = \_\_\_\_\_ months

l.  $2\frac{1}{6}$  hours = [ \_\_\_\_\_ + \_\_\_\_\_ ] minutes = \_\_\_\_\_ minutes

m. 30 months = \_\_\_\_\_ year

n. 80 minutes = \_\_\_\_\_ hour

o. 150 seconds = \_\_\_\_\_ minutes

2. Rasha took  $2\frac{1}{3}$  hours to paint a table and  $1\frac{3}{4}$  hour to paint a chair.

How much time did she take in all ?



3. Karim walked  $2\frac{3}{5}$  km and Sameh walked  $1\frac{2}{3}$  km more.

What distance that Sameh walked ?

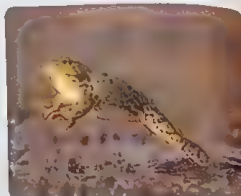


4. Farida bought  $2\frac{1}{2}$  kg of tomato,  $1\frac{3}{8}$  kg of onion and  $5\frac{1}{4}$  kg of potatoes.

How much vegetables did she buy ?

5. A frog took three jumps. The first jump was  $\frac{2}{3}$  m long, the second jump was  $\frac{1}{5}$  m longer the first and the third jump was  $\frac{1}{10}$  m shorter than the second jump.

How long was the third jump ?



6. Habiba is planting three plume thistle plants. It took her  $\frac{5}{6}$  minute to plant the first one. The second plant took  $\frac{1}{12}$  min longer to plant than the first one. The third plant took  $\frac{1}{10}$  less time to plant than the second one.

How long did it take to plant the third plume thistle ?

7. On Monday, Afaf spent  $5\frac{2}{3}$  hours researching papyrus plants for her presentation. The next day, she spent  $\frac{11}{12}$  of an hour less putting her presentation together. Over both days, how many hours did Afaf spend on her presentation ?

8. Rania walked  $3\frac{3}{4}$  km on Monday,  $4\frac{1}{3}$  km on Tuesday and  $2\frac{7}{12}$  km on Wednesday.

What distance did she walk in all ?



9. A vessel contains  $1\frac{1}{2}$  liter of milk. Ahmed drinks  $\frac{1}{4}$  liter of milk and Sara drinks  $\frac{1}{2}$  liter of milk. How much of milk is left in the vessel ?



10. Abeer is mixing juice for a celebration. She mixes  $5\frac{3}{4}$  liters of fruit juice concentrate with  $1\frac{1}{2}$  L more water than fruit juice concentrate. She needs 12 L of the mixture for the celebration. Does she have enough ? Why or why not ? Explain ?

11. Youssef thought the plane journey would take  $2\frac{1}{5}$  hr but the actual journey took 15 minutes longer.

How long did the actual journey take ?

a. Write your answer in hours only.

b. Write your answer in hours and minutes.

c. Write your answer in minutes only.



12. Nana took  $3\frac{2}{3}$  hours to paint a portrait but she has done it in 30 minutes earlier.

How long did she take to paint the portrait ?

a. Write your answer in hours only.

b. Write your answer in hours and minutes.

c. Write your answer in minutes only.



13. A ship traveling up the Nile takes  $6\frac{1}{6}$  hours to reach its destination. On the way back, the current helps push the ship along, so it takes 30 fewer minutes for the return trip. How long is the ship's trip up and down the Nile? Give your answer both as a mixed number and in hours and minutes.

14. Ola baked 4 identical basbousa pans for a celebration. Knowing that some guests like basbousa more than others, she cut each basbousa differently. When the celebration was over, she noticed there was some basbousa left in each pan. There was  $\frac{4}{15}$  left in one pan, and  $\frac{1}{6}$  remained in another. Another pan had  $\frac{5}{12}$  remaining, and  $\frac{3}{10}$  was uneaten in the last. Ola wondered how much basbousa in total was eaten at the celebration.

a. How much basbousa was eaten at the celebration?

b. Which of the four pans had the least basbousa left? How do you know?

c. Ola wants to put the remaining basbousa in one pan. Will it fit? Why or why not?

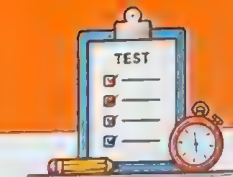
15. Think about the whole numbers and the denominators in the given expression.

$$3\frac{1}{8} + 2\frac{1}{3}$$

Write a story problem that is reasonable for this pair of mixed numbers. Solve your problem.

16. Write an equation using at least three numbers that has  $2\frac{1}{20}$  as a solution. Use both addition and subtraction in your equation and include at least one mixed number.

## Unit Eight Assessment



1. Choose the correct answer.

- a.  $2\frac{3}{5} + 1\frac{4}{5} =$   
 A.  $3\frac{7}{10}$  B.  $4\frac{2}{5}$  C.  $1\frac{1}{5}$  D.  $2\frac{7}{5}$
- b.  $5\frac{2}{7} + k = 6\frac{5}{7}$ , then  $k =$   
 A.  $11\frac{7}{7}$  B.  $1\frac{3}{7}$  C.  $4\frac{3}{7}$  D.  $5\frac{1}{7}$
- c. If  $4\frac{X}{22}$  is slightly greater than  $4\frac{1}{2}$ , then X can be  
 A. 10 B. 21 C. 5 D. 12
- d. Two fractions  $3\frac{2}{3}$  and  $5\frac{1}{6}$  with like denominators are  
 A.  $3\frac{2}{3}$  and  $5\frac{1}{6}$  B.  $\frac{11}{3}$  and  $\frac{31}{3}$  C.  $3\frac{4}{6}$  and  $5\frac{1}{6}$  D.  $3\frac{2}{3}$  and  $5\frac{2}{6}$
- e.  $2\frac{3}{5} + \text{---} = 3\frac{1}{4}$   
 A.  $\frac{13}{20}$  B.  $1\frac{1}{4}$  C.  $1\frac{4}{5}$  D.  $1\frac{2}{5}$
- f.  $2\frac{1}{3}$  hours = --- minutes  
 A. 150 B. 120 C. 130 D. 140
- g.  $\frac{17}{3}$  is equivalent to  
 A.  $3\frac{1}{6}$  B.  $7\frac{1}{2}$  C.  $3\frac{2}{5}$  D.  $5\frac{2}{3}$

2. Complete.

- a.  $3\frac{1}{2} - 2\frac{3}{5} = \text{---}$
- b.  $g - 1\frac{3}{4} = 7\frac{3}{44}$ , then  $g =$
- c.  $7\frac{2}{5} + 1\frac{1}{4} = 8 + 1 + \frac{1}{4} - \text{---}$
- d.  $9\frac{1}{4} - \text{---} = 3\frac{3}{4}$
- e.  $\frac{3}{4}$  year = --- months
- f. 150 seconds = --- minutes
- g.  $X + 5\frac{1}{2} = 7\frac{3}{4}$ , then  $X = \text{---}$
- h.  $2\frac{b}{9}$  is almost 3 Estimate for  $b = \text{---}$

## 3. Choose the correct answer.

a.  $1\frac{5}{8} + 2\frac{7}{12} + \frac{1}{4} =$

A.  $3\frac{7}{12}$

B.  $4\frac{5}{6}$

C.  $4\frac{7}{12}$

D.  $4\frac{11}{24}$

b.  $2\frac{4}{5} + 1\frac{3}{10} - 1\frac{1}{2} =$

A.  $\frac{6}{5}$

B.  $3\frac{2}{5}$

C.  $1\frac{7}{10}$

D.  $2\frac{3}{5}$

c.  $4\frac{3}{5} \neq$

A.  $8\frac{6}{10}$

B.  $2\frac{3}{5}$

C.  $4\frac{6}{10}$

D.  $3\frac{8}{5}$

d. If  $2\frac{2}{3} - h = 1$ , then  $h =$

A.  $3\frac{2}{3}$

B.  $1\frac{2}{3}$

C.  $\frac{2}{3}$

D. 2

e.  $5\frac{3}{7} + 2\frac{1}{11}$  can be estimated as

A. 7

B.  $7\frac{1}{2}$

C. 8

D.  $8\frac{1}{2}$

f.  $7\frac{4}{5} - 3\frac{1}{2} =$

A.  $4\frac{3}{3}$

B.  $4\frac{3}{4}$

C.  $4\frac{3}{10}$

D.  $10\frac{5}{7}$

g. If  $9\frac{X}{5}$  is little greater than  $9\frac{1}{2}$ , then X is estimated as

A. 3

B. 5

C. 2

D. 1

## 4. Answer the following.

- a. Marwan studied math for  $3\frac{1}{2}$  hours and science for 90 minutes.  
How many hours did Marwan study in all?

- b. Sameh ate  $1\frac{3}{4}$  kg of fruits, Bassem ate  $\frac{1}{5}$  kg more than Sameh and Wael ate  $\frac{1}{2}$  kg less than Sameh.  
How many kg of fruits did the three friends eat together?

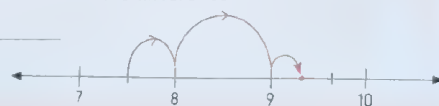
- c. Use an area model to add.

$2\frac{3}{5} + 1\frac{1}{2} =$



- d. Use a number line to find the difference.

$9\frac{1}{3} - 7\frac{1}{2} =$



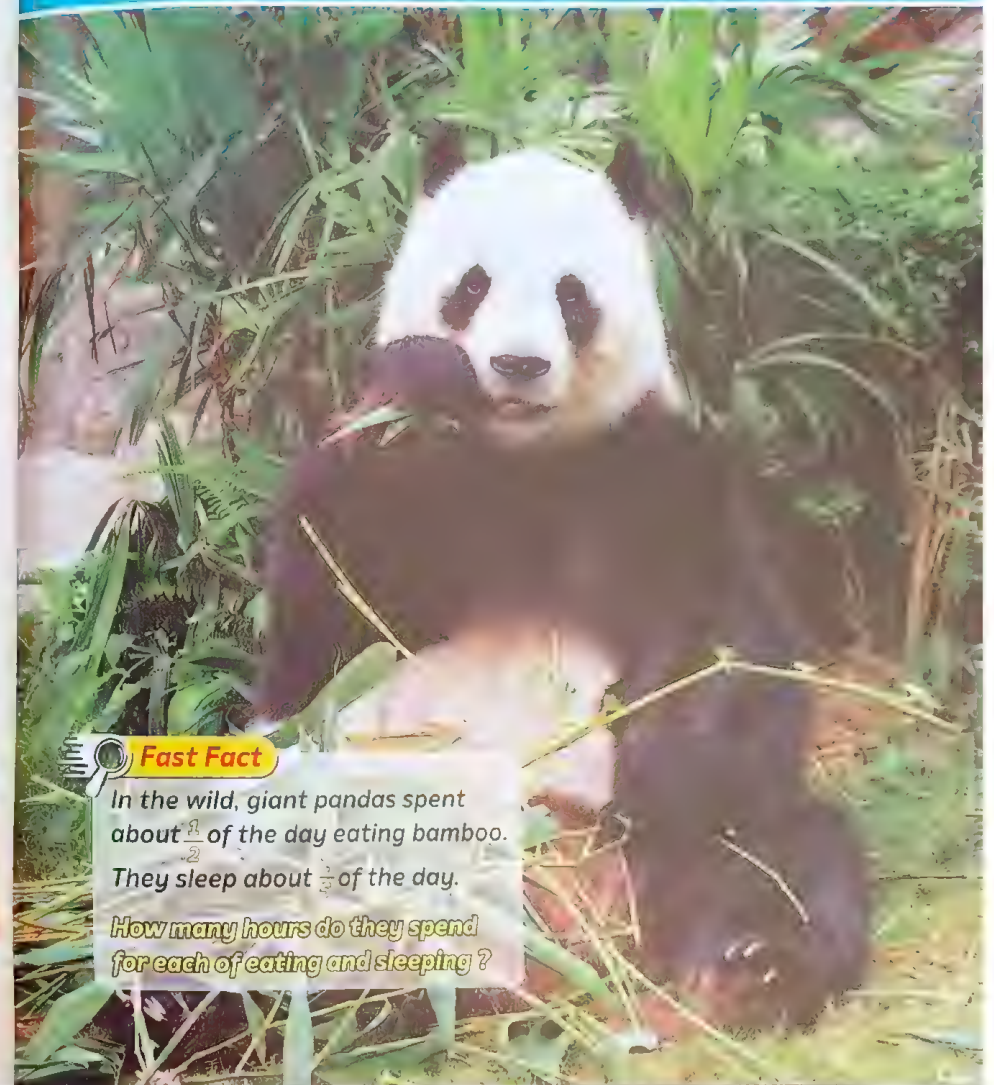
## Theme 3 | Fractions, Decimals and Proportional Relationships

## UNIT 9

## Multiplying and Dividing Fractions

Concept 1: Multiplying Fractions and Mixed Numbers

Concept 2: Dividing Whole Numbers and Unit Fractions



## Fast Fact

In the wild, giant pandas spent about  $\frac{1}{2}$  of the day eating bamboo.

They sleep about  $\frac{1}{3}$  of the day.

How many hours do they spend for each of eating and sleeping?

## Concept

# 1

# Multiplying Fractions and Mixed Numbers

Lessons  
1&2

### Did You Know?!

The length of the table of the tennis table is about  $2\frac{7}{10}$  m and its width is about  $1\frac{1}{2}$  m. What is its area?

Lesson No	Lesson Name	Learning Objectives
Lessons 1&2	Multiplying a Fraction or Mixed Number by a Whole Number	<ul style="list-style-type: none"> <li>Students will multiply a fraction or a mixed number by a whole number.</li> </ul>
Lessons 1&2	Estimating Products of Fractions and Mixed Numbers	<ul style="list-style-type: none"> <li>Students will explain how a product changes when a fraction or mixed number is multiplied by a factor greater than 1.</li> <li>Students will explain how a product changes when a fraction or mixed number is multiplied by a factor less than 1.</li> <li>Students will estimate the product of fractions and mixed numbers.</li> </ul>
Lessons 3&4	Understanding Multiplication with Fractions	<ul style="list-style-type: none"> <li>Students will use models to represent multiplication of a fraction by a fraction.</li> </ul>
Lessons 3&4	Multiplying Fractions by Fractions	<ul style="list-style-type: none"> <li>Students will multiply a fraction by a fraction.</li> <li>Students will simplify fractions.</li> </ul>
Lessons 3&4	Multiplying Fractions and Mixed Numbers	<ul style="list-style-type: none"> <li>Students will multiply a fraction by a mixed number.</li> <li>Students will simplify fractions and mixed numbers.</li> </ul>
Lessons 5 to 7	Multiplying Mixed Numbers	<ul style="list-style-type: none"> <li>Students will draw area models to multiply mixed numbers.</li> <li>Students will use the Distributive Property of Multiplication to multiply mixed numbers.</li> <li>Students will simplify fractions and mixed numbers.</li> </ul>
Lessons 5 to 7	Multiplying Mixed Numbers Using Improper Fractions	<ul style="list-style-type: none"> <li>Students will multiply mixed numbers using improper fractions.</li> <li>Students will simplify fractions and mixed numbers.</li> </ul>
Lesson 8	Story Problems Involving Multiplication of Fractions and Mixed Numbers	<ul style="list-style-type: none"> <li>Students will solve story problems involving multiplication of fractions and mixed numbers.</li> <li>Students will simplify fractions and mixed numbers.</li> </ul>

- Multiplying a Fraction or Mixed Number by a Whole Number
- Estimating Products of Fractions and Mixed Numbers

### Learn 1 Multiplying a fraction or mixed number by a whole number

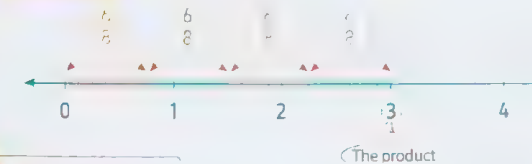
To evaluate:  $\frac{6}{8} \times 4$

#### 1 Using repeated addition

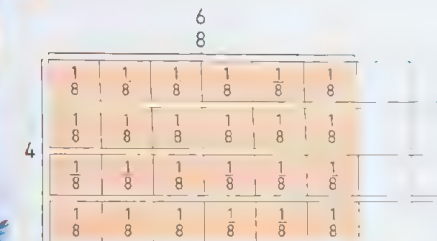
$$\frac{6}{8} \times 4 = \frac{6}{8} + \frac{6}{8} + \frac{6}{8} + \frac{6}{8} = \frac{24}{8} = 3$$

#### 2 Using number line

We divide each unit on the number line into 8 equal parts as the denominator.



#### 3 Using area model



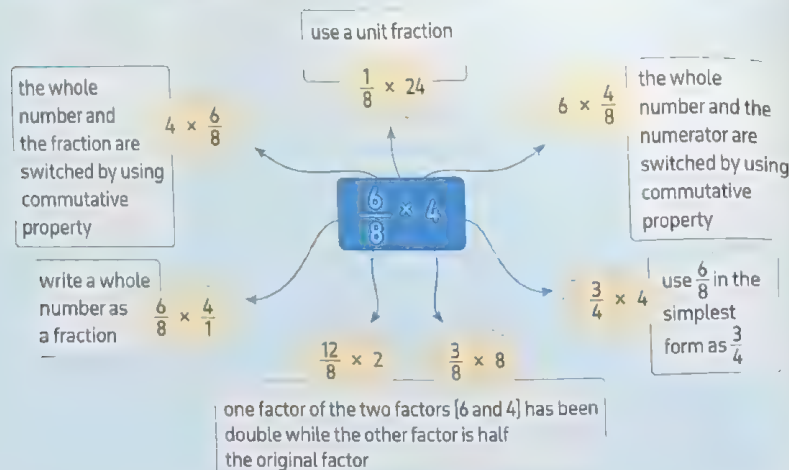
$$\frac{6}{8} \times 4 = \frac{1}{8} \times 24 = \frac{24}{8} = 3$$

#### Note that

To evaluate  $\frac{6}{8} \times 4$  multiply the numerator of the fraction by the whole number as follows:

$$\frac{6}{8} \times 4 = \frac{6 \cdot 4}{8} = \frac{24}{8} = 3$$

There are many different multiplication expressions that have the same product as  $\frac{6}{8} \times 4$



To evaluate:  $1\frac{1}{4} \times 3$

**1 Using repeated addition**

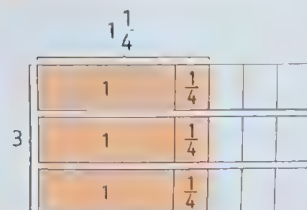
$$1\frac{1}{4} \times 3 = 1\frac{1}{4} + 1\frac{1}{4} + 1\frac{1}{4} = 3\frac{3}{4}$$

**2 Using number line**

We divide each unit on the number line into 4 equal parts as the denominator.



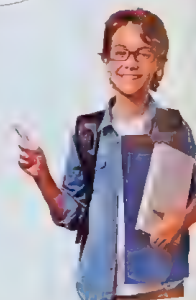
**3 Using area model**



$$1\frac{1}{4} \times 3 = 3 + \frac{3}{4} = 3\frac{3}{4}$$

**4 Using distributive property**

$$1\frac{1}{4} \times 3 = [1 + \frac{1}{4}] \times 3 = 1 \times 3 + \frac{1}{4} \times 3 = 3 + \frac{3}{4} = 3\frac{3}{4}$$



**5 Rewriting the mixed number as an improper fraction**

$$1\frac{1}{4} \times 3 = \frac{5}{4} \times 3 = \frac{15}{4} = 3\frac{3}{4}$$

Note that

$$1\frac{1}{4} = \frac{5}{4}$$

**Example**

Multiply each of the following.

a.  $\frac{1}{6} \times 5$

b.  $\frac{1}{8} \times 2$

c.  $12 \times \frac{3}{4}$

d.  $2\frac{1}{5} \times 3$

e.  $3\frac{3}{8} \times 6$

f.  $\frac{8}{10} \times 8$

**Solution**

a.  $\frac{1}{6} \times 5 = \frac{1 \times 5}{6} = \frac{5}{6}$

b.  $\frac{1}{8} \times 2 = \frac{1}{8} \times \frac{2}{1} = \frac{1 \times 2}{8 \times 1} = \frac{2}{8} = \frac{1}{4}$

c.  $12 \times \frac{3}{4} = 12 \times \frac{3}{4} = \frac{12 \times 3}{4} = \frac{36}{4} = 9$

d.  $2\frac{1}{5} \times 3 = [2 + \frac{1}{5}] \times 3 = 2 \times 3 + \frac{1}{5} \times 3 = 6 + \frac{3}{5} = 6\frac{3}{5}$

e.  $3\frac{3}{8} \times 6 = [3 + \frac{3}{8}] \times 6 = 3 \times 6 + \frac{3}{8} \times 6 = 18 + \frac{18}{8} = 18 + \frac{9}{4} = 18 + 2\frac{1}{4} = 20\frac{1}{4}$

**Another solution:**

$3\frac{3}{8} \times 6 = \frac{27}{8} \times 6 = \frac{27}{8} \times \frac{6}{1} = \frac{27 \times 6}{8} = \frac{162}{8} = 20\frac{1}{4}$

f.  $\frac{8}{10} \times 8 = \frac{8 \times 8}{10} = \frac{64}{10} = 6\frac{4}{10} = 6\frac{2}{5}$

**Check your understanding**

1. Multiply each of the following.

a.  $\frac{3}{5} \times 4$

b.  $2\frac{1}{4} \times 3$

c.  $5\frac{2}{7} \times 8$

2. Write at least two different multiplication expressions that have the same product as  $8 \times \frac{6}{7}$

## Learn 2 Estimating products of fractions and mixed numbers

- If we multiply a given number by a fraction **greater than 1**, then the product is **greater than** the given number.
- If we multiply a given number by a fraction **less than 1**, then the product is **less than** the given number.

For Example:

- $\frac{3}{4} \times \frac{4}{7}$  is less than  $\frac{3}{4}$  (because  $\frac{4}{7} < 1$ )
- $3\frac{5}{6} \times \frac{7}{4}$  is greater than  $3\frac{5}{6}$  (because  $\frac{7}{4} > 1$ )
- $4\frac{2}{3} \times \frac{4}{4}$  is equal to  $4\frac{2}{3}$  (because  $\frac{4}{4} = 1$ )



- If we multiply a given number by a half, then the product is half the given number.

For Example:

- $\frac{4}{5} \times \frac{1}{2} = \text{half of } \frac{4}{5} = \frac{2}{5}$
- $\frac{6}{7} \times 1\frac{1}{2} = \frac{6}{7} \times \{1 + \frac{1}{2}\} = \frac{6}{7} \times 1 + \frac{6}{7} \times \frac{1}{2} = \frac{6}{7} + \frac{3}{7} = \frac{9}{7} = 1\frac{2}{7}$
- $\frac{2}{5} \times 4\frac{1}{2} = \frac{2}{5} \times \{4 + \frac{1}{2}\} = \frac{2}{5} \times 4 + \frac{2}{5} \times \frac{1}{2} = \frac{8}{5} + \frac{1}{5} = \frac{9}{5} = 1\frac{4}{5}$

### Check your understanding

1. Evaluate the product of each of the following (simplify your answers, if possible).

- a.  $\frac{8}{10} \times \frac{1}{2}$       b.  $\frac{4}{9} \times 1\frac{1}{2}$       c.  $\frac{1}{4} \times 3\frac{1}{2}$

2. Choose.

- a.  $3\frac{4}{5} \times \frac{3}{17}$  (less than / greater than / equal to)  $3\frac{4}{5}$   
 b.  $3\frac{4}{5} \times \frac{17}{3}$  (less than / greater than / equal to)  $3\frac{4}{5}$   
 c.  $3\frac{4}{5} \times \frac{17}{17}$  (less than / greater than / equal to)  $3\frac{4}{5}$

## Exercise

### 8

on lessons 1&2

REMEMBER

PROBLEM SOLVING

PROBLEM SOLVING

From the school book

- Multiplying a Fraction or Mixed Number by a Whole Number
- Estimating Products of Fractions and Mixed Numbers

1. Complete using repeated addition.

a.  $\frac{3}{17} \times 5 =$

b.  $\frac{8}{10} \times 3 =$

c.  $2\frac{3}{11} \times 3 =$

d.  $3\frac{1}{3} \times 4 =$

2. Complete using the number line.

a.  $\frac{2}{3} \times 5 =$



b.  $\frac{3}{4} \times 4 =$



c.  $1\frac{1}{5} \times 3 =$



3. Find using the area model.

a.  $\frac{4}{5} \times 3$


b.  $1\frac{3}{4} \times 3$


4. Multiply, then write the result in its simplest form.

a.  $\frac{1}{3} \times 5$

b.  $4 \times \frac{1}{4}$

c.  $\frac{2}{7} \times 21$

d.  $\frac{3}{5} \times 15$

e.  $9 \times \frac{5}{6}$

f.  $\frac{1}{25} \times 10$

g.  $2\frac{3}{7} \times 4$

h.  $5\frac{1}{4} \times 8$

i.  $2\frac{2}{5} \times 6$

5. Complete the input-output tables. Simplify your answers, if possible.

a.

Rule: $\times \frac{9}{10}$	
Input	Output
2	_____
4	_____
6	_____
8	_____

b.

Rule: $\times 10 \frac{1}{4}$	
Input	Output
2	_____
4	_____
6	_____
8	_____

c.

Rule: $\times 3 \frac{5}{8}$	
Input	Output
2	_____
4	_____
6	_____
8	_____

d.

Rule: $\times$ _____	
Input	Output
5	$\frac{5}{9}$
3	_____
4	_____
6	_____

6. As a caretaker, Ezz walks the perimeter of the garden 3 days per week. The perimeter of the garden is  $2 \frac{1}{5}$  kilometers. What is the total distance Ezz walks each week? Use more than one strategy.

7. Ezz notices that  $\frac{2}{3}$  of the 6 rose bushes are in bloom.

How many rose bushes are in bloom?

8. Write at least two different multiplication expressions that have the same product as  $4 \times \frac{6}{10}$

9. Write at least three different multiplication expressions that have the same product as  $\frac{12}{13} \times 8$

10. Using the rule of multiplying by a half to evaluate each product.

a.  $\frac{2}{3} \times \frac{1}{2} =$  \_\_\_\_\_ ,  $\frac{2}{3} \times 1 \frac{1}{2} =$  \_\_\_\_\_

b.  $\frac{4}{5} \times \frac{1}{2} =$  \_\_\_\_\_ ,  $\frac{4}{5} \times 1 \frac{1}{2} =$  \_\_\_\_\_

c.  $\frac{8}{10} \times \frac{1}{2} =$  \_\_\_\_\_ ,  $\frac{8}{10} \times 2 \frac{1}{2} =$  \_\_\_\_\_

d.  $\frac{4}{12} \times \frac{1}{2} =$  \_\_\_\_\_ ,  $\frac{4}{12} \times 3 \frac{1}{2} =$  \_\_\_\_\_

e.  $\frac{3}{5} \times \frac{1}{2} =$  \_\_\_\_\_ ,  $\frac{3}{5} \times 1 \frac{1}{2} =$  \_\_\_\_\_

f.  $\frac{1}{4} \times \frac{1}{2} =$  \_\_\_\_\_ ,  $\frac{1}{4} \times 2 \frac{1}{2} =$  \_\_\_\_\_

11. Complete.

a.  $\frac{4}{11} \times 0.5 =$  \_\_\_\_\_

b.  $\frac{8}{9} \times 3.5 =$  \_\_\_\_\_

c.  $3 \frac{1}{2} \times \frac{6}{9} =$  \_\_\_\_\_

d.  $\frac{6}{8} \times 2 \frac{1}{2} =$  \_\_\_\_\_

e.  $\frac{5}{3} \times 6 \times \frac{2}{7} =$  \_\_\_\_\_

f.  $\frac{2}{5} \times 20 \times \frac{3}{4} =$  \_\_\_\_\_

g.  $1 \frac{2}{7} \times 3 = 1 \times 3 +$  \_\_\_\_\_  $\times$  \_\_\_\_\_

h.  $7 \frac{2}{3} \times 4 =$  \_\_\_\_\_  $\times$  \_\_\_\_\_  $+ \frac{2}{3} \times 4$

i.  $2 \frac{4}{5} \times 3 = 3 \times$  \_\_\_\_\_

j.  $5 \times 3 \frac{2}{11} =$  \_\_\_\_\_  $\times 5$

k.  $4 \frac{7}{8} \times \frac{5}{5} = 4 \frac{7}{8}$

l.  $8 \frac{1}{3} \times \frac{9}{3} = 8 \frac{1}{3}$

m. If  $\frac{4}{13} \times a = \frac{4}{13} + \frac{2}{13}$ , then  $a =$  \_\_\_\_\_

n. If  $\frac{6}{17} \times b = \frac{6}{17} + \frac{6}{17} + \frac{3}{17}$ , then  $b =$  \_\_\_\_\_

12. Indicate whether each product is less than, equal to, or greater than the first factor.

a.  $\frac{3}{5} \times \frac{5}{3}$  (less than / greater than / equal to)  $\frac{3}{5}$

b.  $\frac{3}{5} \times \frac{3}{5}$  (less than / greater than / equal to)  $\frac{3}{5}$

c.  $\frac{3}{5} \times \frac{10}{5}$  (less than / greater than / equal to)  $\frac{3}{5}$

d.  $\frac{3}{5} \times \frac{10}{100}$  (less than / greater than / equal to)  $\frac{3}{5}$

e.  $\frac{7}{4} \times \frac{4}{7}$

(less than / greater than / equal to)

$\frac{7}{4}$

f.  $\frac{7}{4} \times \frac{4}{1}$

(less than / greater than / equal to)

$\frac{7}{4}$

g.  $\frac{7}{4} \times \frac{4}{4}$

(less than / greater than / equal to)

$\frac{7}{4}$

h.  $\frac{7}{4} \times \frac{99}{100}$

(less than / greater than / equal to)

$\frac{7}{4}$

i.  $1\frac{5}{6} \times \frac{5}{6}$

(less than / greater than / equal to)

$1\frac{5}{6}$

j.  $1\frac{5}{6} \times \frac{15}{16}$

(less than / greater than / equal to)

$1\frac{5}{6}$

k.  $1\frac{5}{6} \times \frac{16}{15}$


(less than / greater than / equal to)

$1\frac{5}{6}$

l.  $1\frac{5}{6} \times \frac{16}{16}$

(less than / greater than / equal to)

$1\frac{5}{6}$

13.  Basma sells bunches of colorful chrysanthemums that she ties up with string. The medium bouquet uses  $\frac{6}{10}$  meter of string. The small bouquet uses half as much string as the medium bouquet. The large bouquet uses  $1\frac{1}{2}$  times more string than the medium bouquet. Find how much string Basma uses for the small, medium, and large bouquets of chrysanthemums.



chrysanthemums

## Multiple Choice Questions

Choose the correct answer.

1.  $2\frac{1}{4} \times 4 =$

A.  $8\frac{1}{4}$

B. 9

C.  $9\frac{1}{2}$

D. 10

3.  $\frac{3}{5} \times \frac{1}{2} =$

A.  $\frac{3}{2}$

B.  $\frac{6}{5}$

C.  $\frac{3}{5}$

D.  $\frac{3}{10}$

5.  $7\frac{4}{9} \times \frac{6}{4}$  is —  $7\frac{4}{9}$

A. less than

B. greater than

C. equal to

7. If  $\frac{8}{19} \times a = \frac{8}{19} + \frac{8}{19} + \frac{4}{19}$ , then  $a =$  —

A. 2

B.  $2\frac{1}{2}$

C. 3

D.  $3\frac{1}{2}$

9.  $6 \times 2\frac{5}{8} =$  —

A.  $15\frac{3}{4}$

B.  $12\frac{5}{8}$

C.  $14\frac{3}{8}$

D.  $15\frac{3}{8}$

2.  $5\frac{3}{5} \times \frac{7}{8}$  is  $5\frac{3}{5}$

A. less than

B. greater than

C. equal to

4.  $4\frac{3}{7} \times 5 = 4 \times 5 +$  —

A.  $4 \times \frac{3}{7}$

B.  $\frac{12}{7}$

C.  $\frac{3}{7} \times 5$

D.  $\frac{7}{3} \times 5$

6.  $\frac{8}{11} \times 2.5 =$

A.  $\frac{16}{11}$

B.  $1\frac{9}{11}$

C.  $\frac{11}{20}$

D.  $1\frac{2}{11}$

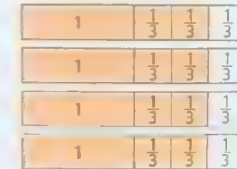
8. The opposite shaded area model represents

A.  $1\frac{1}{3} \times 3$

B.  $1\frac{2}{3} \times 3$

C.  $1\frac{1}{3} \times 4$

D.  $1\frac{2}{3} \times 4$



10.  $5\frac{1}{5} \times \frac{4}{4}$  is —  $5\frac{1}{5}$

A. less than

B. greater than

C. equal to

# LESSONS

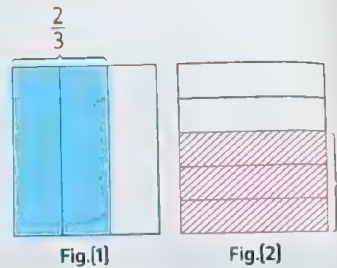
## 3 & 4

- Understanding Multiplication with Fractions
- Multiplying Fractions by Fractions

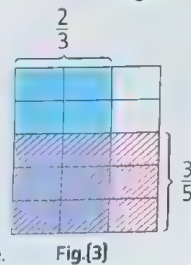
### Learn 1 Multiplying fractions by fractions using rectangular model

To evaluate:  $\frac{2}{3} \times \frac{3}{5}$

- Draw the area model of  $\frac{2}{3}$  vertically as in fig. [1].
- Draw the area model of  $\frac{3}{5}$  horizontally as in fig. [2].



- Use different colors, if possible.
- Imagine the two models if one of them above the other.
- Redraw the models using one rectangle.
- Divide the rectangle vertically into thirds and horizontally into fifths as in fig. [3].
- The product  $\frac{2}{3} \times \frac{3}{5}$  is shown where the shading overlaps.
- We have [6 out of 15] overlapping shading, then  $\frac{2}{3} \times \frac{3}{5} = \frac{6}{15}$  or  $\frac{2}{5}$



### Example 1

Use the area model to evaluate each of the following.

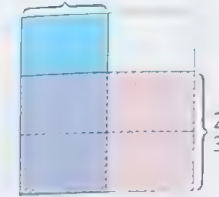
a.  $\frac{1}{2} \times \frac{2}{3}$

b.  $\frac{2}{3} \times \frac{4}{5}$

c.  $\frac{5}{6} \times \frac{3}{4}$

### Solution

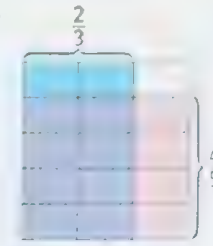
a.  $\frac{1}{2}$



(2 out of 6)

$$\frac{1}{2} \times \frac{2}{3} = \frac{2}{6} \text{ or } \frac{1}{3}$$

b.



(8 out of 15)

$$\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$$

c.



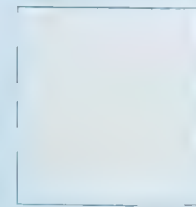
(15 out of 24)

$$\frac{5}{6} \times \frac{3}{4} = \frac{15}{24} \text{ or } \frac{5}{8}$$

### Check your understanding

Use the rectangular model to find each of the following.

a.  $\frac{1}{5} \times \frac{1}{3}$



$$\frac{1}{5} \times \frac{1}{3} =$$

b.  $\frac{1}{4} \times \frac{2}{5}$



$$\frac{1}{4} \times \frac{2}{5} =$$

c.  $\frac{3}{8} \times \frac{1}{2}$



$$\frac{3}{8} \times \frac{1}{2} =$$

## Learn 2 Multiplying fractions by fractions

To evaluate:  $\frac{5}{6} \times \frac{2}{15}$

Step 1

- Multiply the numerators.
- Multiply the denominators.

$$\frac{5}{6} \times \frac{2}{15} = \frac{5 \times 2}{6 \times 15} = \frac{10}{90}$$

Step 2

- Simplify the result.

$$\frac{5}{6} \times \frac{2}{15} = \frac{10}{90} = \frac{1}{9}$$

$$\text{So, } \frac{5}{6} \times \frac{2}{15} = \frac{1}{9}$$

- If the numerator and the denominator have a common factor, then it is better to **simplify before you multiply** by dividing each of them by this common factor as follows:

Step 1

- Simplify the opposite pairs (divide common factor).

$$\frac{5}{6} \times \frac{2}{15} = \frac{\cancel{5}^1}{\cancel{6}_3} \times \frac{\cancel{2}_1}{\cancel{15}_3} = \frac{1}{3} \times \frac{1}{3}$$

Step 2

- Multiply the numerators.
- Multiply the denominators.

$$\frac{\cancel{5}^1}{\cancel{6}_3} \times \frac{\cancel{2}_1}{\cancel{15}_3} = \frac{1 \times 1}{3 \times 3} = \frac{1}{9}$$

$$\text{So, } \frac{5}{6} \times \frac{2}{15} = \frac{1}{9}$$

### Example 2

Multiply each of the following fractions.

a.  $\frac{7}{8} \times \frac{16}{21}$

b.  $\frac{3}{5} \times \frac{25}{36}$

c.  $0.6 \times \frac{1}{2}$

**Solution**

a.  $\frac{7}{8} \times \frac{16}{21} = \frac{\cancel{7}_1}{\cancel{8}_2} \times \frac{\cancel{16}_2}{\cancel{21}_3} = \frac{1 \times 2}{1 \times 3} = \frac{2}{3}$

b.  $\frac{3}{5} \times \frac{25}{36} = \frac{\cancel{3}_1}{\cancel{5}_5} \times \frac{\cancel{25}_5}{\cancel{36}_4} = \frac{1 \times 5}{1 \times 12} = \frac{5}{12}$

c. We convert the decimal into a fraction as:  $0.6 = \frac{3}{5}$ , then  $0.6 \times \frac{1}{2} = \frac{3}{5} \times \frac{1}{2} = \frac{3}{10}$

**Check** your understanding

Multiply.

a.  $\frac{2}{3} \times \frac{3}{4}$

b.  $\frac{5}{6} \times \frac{3}{20}$

c.  $\frac{10}{9} \times \frac{12}{15}$

d.  $\frac{3}{4} \times \frac{16}{9}$

## Exercise 9

on lessons 3&4

REMEMBER

UNDERSTAND

APPLY

PROBLEM SOLVING

From the school book

- Understanding Multiplication with Fractions
- Multiplying Fractions by Fractions

1. Color the area model to evaluate each of the following.

a.  $\frac{1}{2} \times \frac{1}{4}$



, then  $\frac{1}{2} \times \frac{1}{4} = \frac{\quad}{\quad}$

b.  $\frac{2}{3} \times \frac{2}{5}$



, then  $\frac{2}{3} \times \frac{2}{5} = \frac{\quad}{\quad}$

c.  $\frac{3}{4} \times \frac{3}{4}$



, then  $\frac{3}{4} \times \frac{3}{4} = \frac{\quad}{\quad}$

d.  $\frac{1}{7} \times \frac{2}{3}$



, then  $\frac{1}{7} \times \frac{2}{3} = \frac{\quad}{\quad}$

e.  $\frac{4}{5} \times \frac{2}{5}$



, then  $\frac{4}{5} \times \frac{2}{5} = \frac{\quad}{\quad}$

f.  $\frac{5}{6} \times \frac{1}{3}$



, then  $\frac{5}{6} \times \frac{1}{3} = \frac{\quad}{\quad}$

2. Use an area model to show fraction multiplication. Draw a model for each factor and then draw a model to represent the problem. Label each model. Use a different color for each factor. Simplify your answers, if possible.

a.  $\frac{1}{2} \times \frac{1}{5} = \frac{\quad}{\quad}$

b.  $\frac{3}{4} \times \frac{1}{2} = \frac{\quad}{\quad}$

c.  $\frac{5}{6} \times \frac{2}{5} = \frac{\quad}{\quad}$

d.  $\frac{3}{6} \times \frac{5}{6} = \frac{\quad}{\quad}$

e.  $\frac{3}{5} \times \frac{1}{4} = \frac{\quad}{\quad}$

f.  $\frac{3}{4} \times \frac{3}{8} = \frac{\quad}{\quad}$

g.  $\frac{1}{3} \times \frac{3}{8} = \frac{\quad}{\quad}$

h.  $\frac{5}{8} \times \frac{3}{3} = \frac{\quad}{\quad}$

3. Multiply, then write the answer in its simplest form if possible.

a.  $\frac{1}{2} \times \frac{2}{8}$

b.  $\frac{1}{4} \times \frac{1}{4}$

c.  $\frac{1}{3} \times \frac{2}{7}$

d.  $\frac{1}{8} \times \frac{2}{3}$

e.  $\frac{2}{9} \times \frac{3}{8}$

f.  $\frac{1}{2} \times \frac{4}{5}$

g.  $\frac{2}{5} \times \frac{1}{4}$

h.  $\frac{3}{4} \times \frac{8}{9}$

i.  $\frac{4}{9} \times \frac{3}{16}$

j.  $\frac{5}{10} \times \frac{8}{10}$

k.  $\frac{3}{9} \times \frac{3}{4}$

l.  $\frac{3}{8} \times \frac{1}{6}$

m.  $\frac{1}{4} \times \frac{8}{11}$

n.  $\frac{4}{5} \times \frac{4}{9}$

o.  $\frac{5}{12} \times \frac{3}{5}$

p.  $\frac{5}{8} \times \frac{2}{15}$

q.  $\frac{1}{2} \times \frac{4}{13}$

r.  $\frac{5}{3} \times \frac{9}{20}$

s.  $\frac{2}{3} \times \frac{6}{7} \times \frac{7}{8}$

t.  $\frac{4}{10} \times \frac{25}{3} \times \frac{3}{15}$

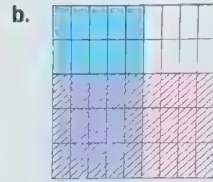
u.  $\frac{4}{7} \times \frac{14}{24} \times \frac{3}{5}$

v.  $\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \frac{5}{6} \times \frac{6}{7} \times \frac{7}{8}$

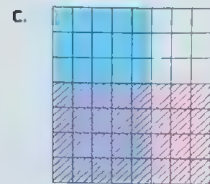
4. Study the multiplication area models and fill in the missing fraction. Then, enter the product. Simplify your answers, if possible.



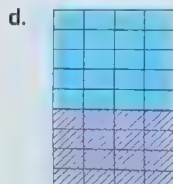
$\frac{2}{6} \times \quad =$



$\times \frac{3}{5} =$



$\frac{5}{8} \times \quad =$



$\times \frac{4}{9} =$



5. Multiply, then write the answer in its simplest form.

a.  $0.25 \times \frac{4}{5}$

b.  $\frac{4}{20} \times 0.8$

c.  $\frac{3}{5} \times 1.5$

d.  $0.6 \times \frac{15}{16} \times \frac{8}{9}$

e.  $\frac{1}{25} \times 50 \times 0.25$

f.  $0.6 \times 20 \times \frac{2}{5}$

6. Complete.

a.  $\frac{1}{4} \times \frac{\quad}{3} = \frac{7}{12}$

b.  $\frac{4}{5} \times \frac{\quad}{\quad} = \frac{4}{15}$

c.  $\frac{1}{2} \times \frac{\quad}{\quad} = \frac{3}{8}$

d.  $\frac{2}{7} \times \frac{\quad}{\quad} = \frac{10}{49}$

e.  $\frac{\quad}{\quad} \times \frac{3}{8} = \frac{15}{24}$

f.  $\frac{\quad}{\quad} \times \frac{3}{5} = \frac{6}{15}$

g.  $\frac{\quad}{\quad} \times \frac{3}{17} = \frac{2}{17}$

h.  $\frac{\quad}{\quad} \times \frac{1}{4} \times \frac{2}{5} = \frac{1}{15}$

i.  $\frac{2}{3} \times \frac{\quad}{\quad} \times \frac{3}{4} = \frac{1}{4}$

7. Aya is planning a garden. She wants

$\frac{2}{3}$  of her garden to be planted with vegetables. She also wants  $\frac{1}{4}$  of the vegetables to be leeks and  $\frac{3}{4}$  of them to be peas.

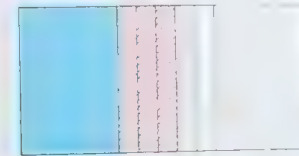
Explain whether she can use multiplication to describe the fraction of her garden that will contain leeks and the fraction that will contain peas.



Pea Pods

8. Maha made a model for  $\frac{1}{3} \times \frac{3}{5}$  but is having trouble finding the product.

Help her fix her model. Then, find the product and explain your thinking.



Choose the correct answer.

1.  $\frac{2}{15} \times \frac{5}{6} =$  \_\_\_\_\_

- A.  $\frac{1}{3}$  B.  $\frac{1}{6}$  C.  $\frac{1}{8}$  D.  $\frac{1}{9}$

3.  $\frac{1}{4} \times \frac{4}{5}$    $\frac{1}{2} \times \frac{2}{5}$

- A. > B. < C. =

5.  $0.25 \times \frac{8}{9} =$  \_\_\_\_\_

- A.  $\frac{1}{4}$  B.  $\frac{2}{3}$  C.  $\frac{4}{9}$  D.  $\frac{2}{9}$

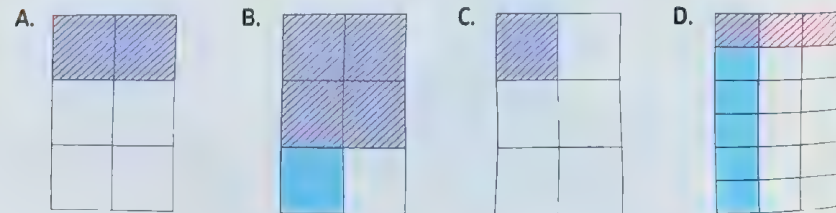
7.  $\frac{2}{3} \times \frac{3}{8} \times \frac{8}{9} =$  \_\_\_\_\_

- A.  $\frac{1}{3}$  B.  $\frac{2}{9}$  C.  $\frac{13}{20}$  D.  $\frac{2}{17}$

9. The opposite model represents

- A.  $\frac{1}{3} \times \frac{2}{3}$  B.  $\frac{1}{4} \times \frac{2}{5}$   
C.  $\frac{3}{4} \times \frac{3}{5}$  D.  $\frac{1}{4} \times \frac{3}{4}$

10. Which of the models below shows  $\frac{1}{6} \times \frac{1}{3}$ ?



2.  $\frac{1}{5} \times 0.5 =$  \_\_\_\_\_

- A.  $\frac{2}{7}$  B.  $\frac{1}{7}$  C.  $\frac{1}{10}$  D.  $\frac{1}{25}$

4. What is the product of  $\frac{4}{5}$  and  $\frac{3}{3}$ ?

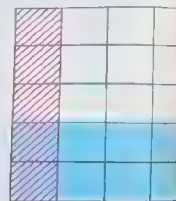
- A.  $\frac{4}{5}$  B.  $\frac{7}{8}$  C. 1 D.  $\frac{4}{15}$

6.  $\frac{3}{5} \times \frac{4}{5} = \frac{12}{35}$

- A. 5 B. 6 C. 7 D. 8

8.  $\frac{1}{3} \times \frac{6}{7}$    $\frac{4}{7} - \frac{1}{7}$

- A. > B. < C. =



## Lessons 5 to 7

- Multiplying Fractions and Mixed Numbers
- Multiplying Mixed Numbers
- Multiplying Mixed Numbers Using Improper Fractions

### Learn

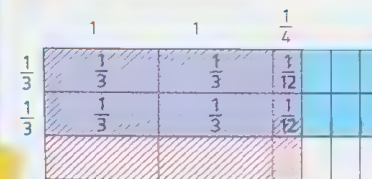
Multiplying a mixed number by a fraction or a mixed number

To evaluate:  $2\frac{1}{4} \times \frac{2}{3}$



It is important to draw one factor horizontally and the other factor vertically.

### 1 Using area model



$$2\frac{1}{4} \times \frac{2}{3} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{12} + \frac{1}{12} = \frac{4}{3} + \frac{2}{12} = \frac{16}{12} + \frac{2}{12} = \frac{18}{12} = \frac{3}{2} = 1\frac{1}{2}$$

$$2\frac{1}{4} \times \frac{2}{3}$$

### 2 Using distributive property

$$2\frac{1}{4} \times \frac{2}{3} = (2 + \frac{1}{4}) \times \frac{2}{3} = (2 \times \frac{2}{3}) + (\frac{1}{4} \times \frac{2}{3}) = \frac{4}{3} + \frac{2}{12} = \frac{4}{3} + \frac{1}{6} = \frac{8}{6} + \frac{1}{6} = \frac{9}{6} = \frac{3}{2} = 1\frac{1}{2}$$

### 3 Using improper fractions

$$2\frac{1}{4} \times \frac{2}{3} = \frac{9}{4} \times \frac{2}{3} = \frac{3}{2} = 1\frac{1}{2}$$

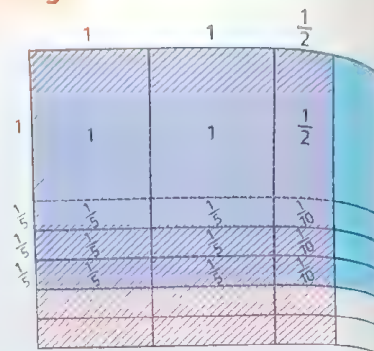


To evaluate:  $2\frac{1}{2} \times 1\frac{3}{5}$

### 1 Using area model

$$2\frac{1}{2} \times 1\frac{3}{5} = 1 + 1 + \frac{1}{2} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10}$$

$$= 2 + \frac{1}{2} + \frac{6}{5} + \frac{3}{10} = \frac{20 + 5 + 12 + 3}{10} = \frac{40}{10} = 4$$



### 2 Using distributive property

$$2\frac{1}{2} \times 1\frac{3}{5} = (2 + \frac{1}{2}) \times (1 + \frac{3}{5})$$

$$= (2 \times 1) + (2 \times \frac{3}{5}) + (\frac{1}{2} \times 1) + (\frac{1}{2} \times \frac{3}{5})$$

$$= 2 + \frac{6}{5} + \frac{1}{2} + \frac{3}{10} = 2 + \frac{12}{10} + \frac{5}{10} + \frac{3}{10}$$

$$= 2 + \frac{20}{10} = 2 + 2 = 4$$

### 3 Using improper fraction

$$2\frac{1}{2} \times 1\frac{3}{5} = \frac{5}{2} \times \frac{8}{5} = \frac{4}{1} = 4$$

### Example

Multiply each of the following.

a.  $2\frac{3}{4} \times 1\frac{2}{3}$  [using area model]

b.  $1\frac{3}{4} \times 1\frac{2}{7}$  [using distributive property]

c.  $\frac{5}{6} \times 7\frac{1}{2}$  [using improper fraction]

### Solution

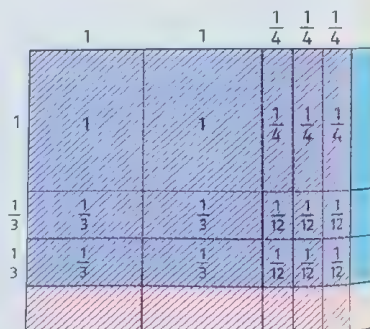
a.  $2\frac{3}{4} \times 1\frac{2}{3}$

$$= 1 + 1 + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$$

$$+ \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{12} + \frac{1}{12} + \frac{1}{12} + \frac{1}{12} + \frac{1}{12} + \frac{1}{12}$$

$$= 2 + \frac{4}{3} + \frac{3}{4} + \frac{6}{12} = 2 + \frac{16}{12} + \frac{9}{12} + \frac{6}{12}$$

$$= 2 + \frac{31}{12} = 2 + 2\frac{7}{12} = 4\frac{7}{12}$$



b.  $1\frac{3}{4} \times 1\frac{2}{7} = (1 + \frac{3}{4}) \times (1 + \frac{2}{7})$

$$= (1 \times 1) + (1 \times \frac{2}{7}) + (\frac{3}{4} \times 1) + (\frac{3}{4} \times \frac{2}{7})$$

$$= 1 + \frac{2}{7} + \frac{3}{4} + \frac{6}{28}$$

$$= 1 + \frac{8}{28} + \frac{21}{28} + \frac{6}{28} = 1 + \frac{35}{28}$$

$$= 1 + \frac{5}{4} = 1 + 1\frac{1}{4} = 2\frac{1}{4}$$

c.  $\frac{5}{6} \times 7\frac{1}{2} = \frac{5}{6} \times \frac{15}{2} = \frac{25}{4} = 6\frac{1}{4}$



### Remarks

- We know that:  $3\frac{1}{5}$  equals  $(3 + \frac{1}{5})$  Doesn't equal  $(3 \times \frac{1}{5})$   
So,  $(3\frac{1}{5}) \times (4\frac{1}{2})$  equals  $(3 + \frac{1}{5}) \times (4 + \frac{1}{2})$  Doesn't equal  $(3 \times \frac{1}{5}) + (4 \times \frac{1}{2})$
- We know that:  $3\frac{4}{7} \times \frac{2}{5}$  equals  $\frac{2}{5} \times 3\frac{4}{7}$  Doesn't equal  $3\frac{2}{5} \times \frac{4}{7}$
- To estimate  $(3\frac{4}{5} \times \frac{1}{4})$  we find that:  
 $3\frac{4}{5} \times \frac{1}{4}$  is less than  $3\frac{4}{5}$  (because  $\frac{1}{4} < 1$ )  
There is more accurate estimation we can be done:  $3\frac{4}{5}$  is rounded up to 4  
So,  $3\frac{4}{5} \times \frac{1}{4}$  is rounded up  $4 \times \frac{1}{4}$  or 1  
So,  $3\frac{4}{5} \times \frac{1}{4} < 1$

### Check your understanding

Multiply, then write the result in its simplest form.

a.  $3\frac{4}{7} \times \frac{1}{5}$

b.  $4\frac{2}{3} \times \frac{3}{7}$

c.  $5\frac{1}{3} \times 2\frac{5}{8}$

d.  $4\frac{2}{5} \times 1\frac{4}{11}$

## Exercise

10

on lessons 5 to 7

REMEMBER

UNDERSTAND

APPLY

PROBLEM SOLVING

From the school book

- Multiplying Fractions and Mixed Numbers
- Multiplying Mixed Numbers
- Multiplying Mixed Numbers Using Improper Fractions

1. Use an area model to multiply two mixed numbers. Fill in the squares to create an area model to find each product. Simplify your answers, if possible.

a.  $1\frac{1}{2} \times 2\frac{2}{3} =$



b.  $2\frac{3}{4} \times 1\frac{2}{3} =$



c.  $1\frac{1}{3} \times 2\frac{3}{4} =$



d.  $3\frac{1}{2} \times 1\frac{2}{5} =$



e.  $2\frac{2}{3} \times 3\frac{1}{5} =$



f.  $2\frac{1}{4} \times 3\frac{1}{3} =$



2. Evaluate each product using the distributive property of multiplication. Simplify your answers, if possible.

a.  $\frac{2}{5} \times 5\frac{1}{2} =$

b.  $1\frac{2}{3} \times \frac{3}{10} =$

c.  $8\frac{3}{4} \times \frac{2}{7} =$

d.  $\frac{3}{4} \times 8\frac{2}{3} =$

e.  $3\frac{4}{6} \times \frac{1}{4} =$

f.  $\frac{3}{4} \times 2\frac{1}{5} =$

g.  $2\frac{2}{5} \times \frac{2}{3} =$

h.  $\frac{1}{8} \times 3\frac{2}{5} =$

i.  $5\frac{1}{4} \times \frac{1}{2} =$

3. Use the distributive property of multiplication to find each product. Simplify your answers, if possible.

a.  $2\frac{2}{5} \times 1\frac{1}{2} =$

$$(\text{---} + \text{---}) \times (\text{---} + \text{---})$$

$$= (\text{---} \times \text{---}) + (\text{---} \times \text{---})$$

$$+ (\text{---} \times \text{---}) + (\text{---} \times \text{---})$$

$$= \text{---} + \text{---} + \text{---} + \text{---}$$

$$= \text{---}$$

b.  $2\frac{2}{3} \times 4\frac{3}{5} =$

$$(\text{---} + \text{---}) \times (\text{---} + \text{---})$$

$$= (\text{---} \times \text{---}) + (\text{---} \times \text{---})$$

$$+ (\text{---} \times \text{---}) + (\text{---} \times \text{---})$$

$$= \text{---} + \text{---} + \text{---} + \text{---}$$

$$= \text{---}$$

c.  $3\frac{1}{2} \times 2\frac{2}{7} =$

d.  $2\frac{1}{2} \times 1\frac{1}{10} =$

e.  $5\frac{1}{3} \times 3\frac{3}{8} =$

f.  $1\frac{2}{7} \times 2\frac{1}{3} =$

g.  $3\frac{2}{3} \times 2\frac{1}{4} =$

h.  $5\frac{2}{3} \times 1\frac{2}{3} =$

4. Match each mixed number to its equivalent improper fraction.

Mixed Number

Improper Fraction

a.  $3\frac{1}{2}$

b.  $4\frac{3}{5}$

c.  $2\frac{1}{5}$

d.  $6\frac{1}{5}$

e.  $5\frac{1}{2}$

f.  $2\frac{3}{5}$

g.  $1\frac{1}{3}$

h.  $2\frac{2}{3}$

$$\frac{31}{5}$$

$$\frac{7}{2}$$

$$\frac{4}{3}$$

$$\frac{11}{5}$$

$$\frac{13}{5}$$

$$\frac{8}{3}$$

$$\frac{23}{5}$$

$$\frac{11}{2}$$



5. Rewrite the mixed numbers as improper fractions. Then, simplify before you multiply. Be sure to simplify your answers.

a.  $2\frac{1}{4} \times 2\frac{2}{3} =$

b.  $1\frac{5}{6} \times 4\frac{2}{5} =$

c.  $3\frac{1}{2} \times 1\frac{3}{4} =$

d.  $4\frac{2}{7} \times 2\frac{1}{3} =$

e.  $1\frac{1}{3} \times 1\frac{3}{8} =$

f.  $3\frac{1}{3} \times 5\frac{2}{5} =$

g.  $5\frac{2}{7} \times 2\frac{6}{11} =$

h.  $10\frac{2}{5} \times 4\frac{3}{8} =$

6. Choose the correct answer.

a.  $7\frac{1}{2} \times \frac{1}{15} =$

A. 2

B.  $\frac{1}{2}$ C.  $\frac{16}{17}$ D.  $7\frac{1}{30}$ 

b.  $1\frac{1}{4} \times 1\frac{1}{5} \times 1\frac{1}{6} =$

A.  $1\frac{3}{4}$ B.  $1\frac{1}{120}$ C.  $1\frac{1}{15}$ D.  $1\frac{1}{5}$ 

c.  $4\frac{2}{3} \times 1\frac{2}{7} =$

A.  $4\frac{4}{21}$ B.  $5\frac{20}{21}$ C.  $4\frac{2}{21}$ 

D. 6

d.  $2\frac{1}{5} \times 0.5$

☐  $\frac{11}{10}$

A. &lt;

B. &gt;

C. =

e.  $1\frac{1}{3} \times 1\frac{2}{7}$  ☐  $2\frac{1}{7} - \frac{3}{7}$

A. < B. > C. =

f.  $\frac{3}{8} \times 1\frac{3}{5}$  ☐  $\frac{3}{50}$

A. < B. > C. =

g.  $2\frac{1}{3} \times \text{---} = 1$

A.  $\frac{7}{3}$  B.  $\frac{3}{7}$  C.  $3\frac{1}{2}$  D. 6

h. Which of the following is not equal to  $4 \times 5\frac{2}{3}$ ?

A.  $5 \times 4\frac{2}{3}$  B.  $\frac{68}{3}$  C.  $\frac{4}{3} \times 17$  D.  $\frac{17}{3} \times 4$

7. Ola and Omina were planting flowers in their garden. Ola had 2 bags of flower seeds, but Omina had only  $\frac{3}{4}$  of a bag of seeds. Each girl planted  $\frac{1}{2}$  of the seeds she had. How many bags of seeds did they plant altogether?



Planting Seeds

8. Two students tried multiplying a mixed number by a fraction using the distributive property of multiplication. Look at their solutions. Find and correct the errors.

Given:  $3\frac{5}{8} \times \frac{2}{3}$

Nabila's Solution	Basem's Solution
$3\frac{5}{8} \times \frac{2}{3}$ $(3 \times \frac{2}{3}) + (\frac{5}{8} \times \frac{2}{3})$ $\frac{6}{3} + \frac{10}{24}$ $2 + \frac{5}{12}$ $2\frac{5}{12}$	$3\frac{5}{8} \times \frac{2}{3}$ $(3 \times \frac{2}{3}) \times (\frac{5}{8} \times \frac{2}{3})$ $\frac{6}{3} \times \frac{10}{24}$ $2 \times \frac{5}{12}$ $2\frac{5}{12}$

9. Ayman is taking inventory of his landscaping supplies. He has  $3\frac{1}{2}$  bags of fertilizer. Each bag weighs  $7\frac{3}{4}$  kilograms. He writes that there are  $21\frac{3}{8}$  kg of fertilizer in all. Is Ayman correct? Explain your thinking.



Fertilizer

## Multiple Choice Questions

Choose the correct answer.

1.  $4\frac{1}{2} \times 2\frac{2}{3} = \text{---}$

A. 12 B.  $8\frac{1}{3}$   
C.  $5\frac{2}{3}$  D.  $\frac{17}{6}$

2.  $2\frac{5}{7} \times \frac{1}{5} = (2 \times \frac{1}{5}) + (\text{---} \times \frac{1}{5})$

A. 2 B.  $\frac{1}{5}$   
C.  $\frac{5}{7}$  D.  $\frac{19}{35}$

3.  $4\frac{1}{4} \times \frac{3}{5} = 4 \times \frac{3}{5}$

A.  $\frac{1}{4}$  B.  $\frac{4}{17}$   
C. 17 D. 4

4.  $\frac{1}{8} \times 7\frac{5}{6} = \text{---}$

A. > B. < C. =

5.  $1\frac{1}{5} \times \text{---} = 1$

A. 5 B.  $\frac{5}{4}$   
C.  $\frac{5}{6}$  D.  $\frac{6}{5}$

6. Which of the following is not equal to  $8 \times 4\frac{1}{6}$ ?

A.  $8 \times \frac{25}{6}$  B.  $\frac{8}{3} \times \frac{25}{2}$   
C.  $\frac{100}{3}$  D.  $4 \times 8\frac{1}{6}$

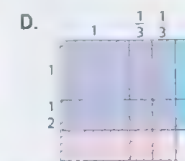
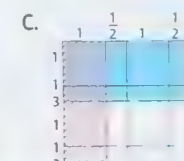
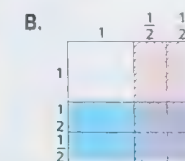
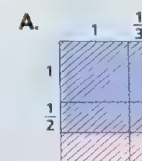
7.  $3\frac{3}{4} \times 5\frac{1}{3} = \text{---}$

A. 12 B.  $15\frac{1}{4}$   
C. 20 D. 24

8.  $(2 \times 3) + (2 \times \frac{5}{7}) + (\frac{1}{2} \times 3) + (\frac{1}{2} \times \frac{5}{7})$

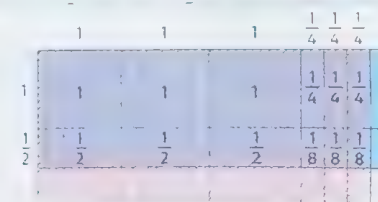
A.  $2\frac{5}{7} \times 3\frac{1}{2}$  B.  $2\frac{1}{2} \times 3\frac{5}{7}$   
C.  $3\frac{5}{7} \times 2\frac{5}{7}$  D.  $2\frac{1}{2} \times 3\frac{1}{2}$

9. Which of the following represent  $1\frac{1}{3} \times 1\frac{1}{2}$ ?



10. The opposite model represents

A.  $1\frac{1}{4} \times 1\frac{1}{2}$  B.  $3\frac{1}{4} \times 1\frac{1}{2}$   
C.  $3\frac{3}{4} \times 1\frac{1}{2}$  D.  $3\frac{3}{4} \times \frac{1}{2}$



## Story Problems Involving Multiplication of Fractions and Mixed Numbers

### Example 1

Marvina purchased a bag of mango from the market that has a mass of  $3\frac{1}{4}$  kilograms. Her sister Sandy purchased a bag of orange that has a mass of  $1\frac{1}{2}$  times more than Marvina's bag of mango.

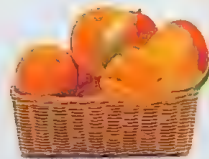
What is the mass of Sandy's bag of orange?

#### Solution

Marvina has  $3\frac{1}{4}$  kg

Sandy has  $1\frac{1}{2}$  times more than Marvina.

$$\text{Sandy has } 1\frac{1}{2} \times 3\frac{1}{4} = \frac{3}{2} \times \frac{13}{4} = \frac{39}{8} = 4\frac{7}{8} \text{ kg}$$



### Example 2

Youssef is reading a book. He can usually read  $5\frac{1}{2}$  pages in 1 hour. If he plans to read for 2 hours and 15 minutes.

How many pages will he read?

#### Solution

Youssef read  $5\frac{1}{2}$  pages in 1 hour.

and (2 hours and 15 minutes) equals  $2\frac{1}{4}$  hours

, then the number of pages he will read

$$= 5\frac{1}{2} \times 2\frac{1}{4} = \frac{11}{2} \times \frac{9}{4} = \frac{99}{8}$$

$$= 12\frac{3}{8} \text{ pages.}$$

Note that

$$15 \text{ minutes} = \frac{1}{4} \text{ hour}$$

$$30 \text{ minutes} = \frac{1}{2} \text{ hour}$$

$$45 \text{ minutes} = \frac{3}{4} \text{ hour}$$



## Exercise 11

on lesson 8

REMEMBER

UNDERSTAND

APPLY

PROBLEM SOLVING

From the school book

- Aya purchased a bag of tomatoes from the market that has a mass of  $2\frac{1}{3}$  kilograms. Her brother, Ameen, purchased a bag of potatoes that has a mass  $1\frac{1}{2}$  times more than Aya's bag of tomatoes. What is the mass of Ameen's bag of potatoes?

- Nada is making spaghetti sauce.

The recipe calls for  $1\frac{3}{4}$  cups of water, she wants to make  $4\frac{1}{2}$  times the recipe.

How much water should she use?



- Moustafa is harvesting sugarcane.

He can harvest  $3\frac{3}{4}$  kilograms of sugarcane in 1 hour. If he plans to work for  $2\frac{1}{2}$  hours,

How much sugarcane will he harvest?



sugarcane

- Seif bought 4 bags of soil for his garden.

Each bag has a mass of  $3\frac{1}{3}$  kilograms. If he only used  $3\frac{3}{4}$  bags of soil,

How many kilograms did he use?

- Nagwa bought  $2\frac{2}{3}$  liters of mango juice for  $8\frac{3}{8}$  L.E. for each liter

How much money did she pay?



6. A mother is  $1\frac{3}{8}$  times as tall as her daughter.  
The girl is  $1\frac{1}{3}$  times as tall as her brother.  
How many times the mother is as tall as her son?



7. Farida is reading a chapter book. She can usually read  $20\frac{1}{2}$  pages in 1 hour. If she plans to read for 1 hour and 15 minutes, how many pages will she read?

8. Giovanni earns  $7\frac{1}{2}$  L.E. for an hour. He works 4 hours and 40 minutes per day, 5 days per week.  
How much money does he earn per day?  
How much money does he earn in 2 weeks?

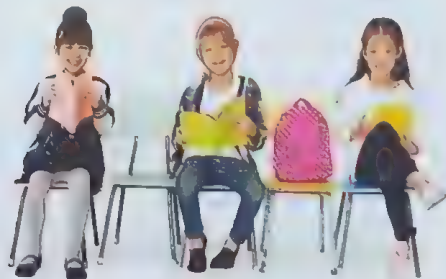


9. **Time for a Story.** Write a multiplication story problem using each given pair of mixed numbers. Share your problem with a partner, and then solve your partner's problem. Be sure to simplify your answers, if possible.

a.  $12\frac{1}{2}$  and  $3\frac{2}{3}$

b.  $1\frac{4}{5}$  and  $2\frac{2}{3}$

c.  $5\frac{3}{4}$  and  $1\frac{1}{5}$



## Concept 2

## Dividing Whole Numbers and Unit Fractions



### Fast Fact

Newborn babies spend  $16$  hours in a day sleeping.

*What is the fraction represents the number of sleeping hours daily?*



Lesson No.	Lesson Name	Learning Objectives
Lessons 9 & 10	Fractions as Division	• Students will explain how fractions represent division of whole numbers.
	Story Problems Involving Fractions as Division	• Students will solve story problems involving division of whole numbers and quotients of fractions or mixed numbers. • Students will simplify fractions and mixed numbers
Lessons 11 & 12	Dividing Unit Fractions by Whole Numbers	• Students will use models to divide unit fractions by whole numbers. • Students will explain the relationship between division and multiplication of fractions.
	Dividing Whole Numbers by Unit Fractions	• Students will use models to divide whole numbers by unit fractions • Students will apply the relationship between division and multiplication of fractions to solve problems
Lesson 13	Story Problems Involving Division of Whole Numbers and Unit Fractions	• Students will solve story problems involving division of whole numbers and unit fractions • Students will simplify fractions and mixed numbers

# Lessons 9 & 10

## Fractions as Division Story Problems Involving Fractions as Division

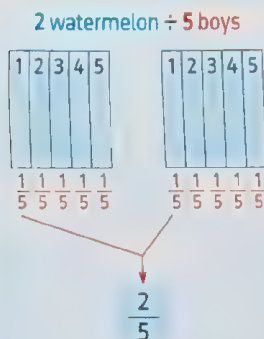
### Learn Fractions as division

- If you distribute 2 watermelons among 5 boys

, then each boy has  $2 \div 5$  or  $\frac{2}{5}$



Using model to find quotient



Note that

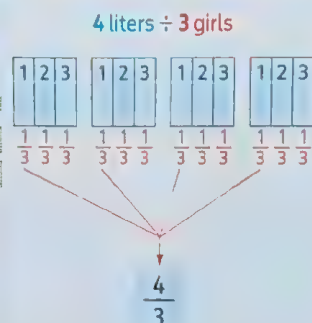
$2 \div 5$  means  $\frac{2}{5}$

- The dividend [2] is the numerator
- The divisor [5] is the denominator
- The division symbol [ $\div$ ] is the fraction bar, then fractions can represent division.

- If you distribute 4 liters of milk among 3 girls

, then each girl has  $4 \div 3$  or  $\frac{4}{3}$  liter

Using model to find quotient



Division algorithm

$$\begin{array}{r} 1\frac{1}{3} \\ 3 \overline{) 4} \\ \underline{- 3} \\ 1 \end{array}$$

$$4 \div 3 = \frac{4}{3} = 1\frac{1}{3}$$

[quotient as a mixed number]

### Example 1

Write the division expression that represents each of the following situations and write the quotient as a mixed number [using division algorithm].

- Divide 7 oranges between 2 students.
- Distribute 7 apples among 4 students.

### Solution

- a. The division expression:  $7 \div 2$

$$7 \div 2 = \frac{7}{2} = 3\frac{1}{2}$$

$$\begin{array}{r} 3\frac{1}{2} \\ 2 \overline{) 7} \\ \underline{- 6} \\ 1 \end{array}$$

- b. The division expression:  $7 \div 4$

$$7 \div 4 = \frac{7}{4} = 1\frac{3}{4}$$

$$\begin{array}{r} 1\frac{3}{4} \\ 4 \overline{) 7} \\ \underline{- 4} \\ 3 \end{array}$$

### Example 2

If the price of 12 pens is 32 L.E. Find the price of each pen.

### Solution

$$\text{Price of each pen} = 32 \div 12 = \frac{32}{12} = \frac{8}{3} = 2\frac{2}{3} \text{ L.E.}$$

### Check your understanding

Divide 13 pizzas among 4 girls, what is the share of each girl?



# Exercise 12

on lessons 9&10

REMEMBER UNDERSTAND APPLY PROBLEM SOLVING

From the school book

## Fractions as Division Story Problems Involving Fractions as Division

1. Match each situation with the division expression that represents it.

Using graph paper or the Whiteboard, create a model that represents each scenario. Then find the quotient. Simplify your answer, if possible.

1. 2 bales of cotton shared by 3 manufacturers.
2. 3 bales of cotton shared by 2 manufacturers.
3. 5 bales of cotton shared by 2 manufacturers.
4. 3 bales of cotton shared by 5 manufacturers.
5. 2 bales of cotton shared by 4 manufacturers.
6. 2 bales of cotton shared by 5 manufacturers.

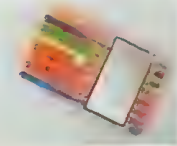
- A.  $4 \div 2$
- B.  $2 \div 5$
- C.  $2 \div 3$
- D.  $3 \div 2$
- E.  $5 \div 3$
- F.  $2 \div 4$
- G.  $5 \div 2$
- H.  $3 \div 5$

2. Complete the chart. Write the quotient as a mixed number and simplify, if possible.

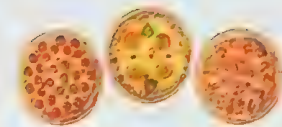
Then, use the division algorithm and write the remainder as a fraction.

Expression	Quotient	Division algorithm
Example: $6 \div 5$	$\frac{6}{5} = 1\frac{1}{5}$	$\begin{array}{r} 1\frac{1}{5} \\ 5 \overline{) 6} \\ \underline{- 5} \\ 1 \end{array}$
a. $8 \div 5$		
b. $4 \div 3$		
c. $6 \div 3$		
d. $5 \div 4$		
e. $3 \div 2$		

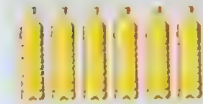
3. The price of 8 pens is 12 L.E.  
Find the price of each pen.



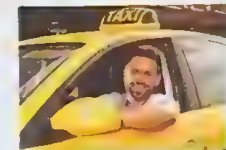
4. Divide 3 pizzas among 5 persons equally,  
what is the share of each person?



5. If you want to distribute 22 liters of oil in 6 small bottles equally,  
find the volume of oil in each bottles?



6. 3 persons shared a taxi fare equally, if they paid total 28 L.E.  
How much money did each of them pay?



7. Sameh ran 10 kilometers in 70 minutes. How many kilometers per minute did he run?

8. Shehab has 6 houseplants. It took him 45 minutes to replant them. How long did it take him to replant each one?

9. The flower shop received 8 equal-sized bundles of chrysanthemums and 10 vases.  
If the bundles are divided equally among 10 vases, what part of a bundle will each vase get?

10. The flower shop has 12 meters of ribbon to make equal-sized bows for each of the 8 birthday bouquets they are making. How many meters of ribbon can be used for each bouquet?

11. The flower shop needs to care for 8 rose bouquets. They have 5 packets of flower food. If they want to share the food equally among the bouquets, what part of a packet of food will each bouquet receive?

12. The flower shop wants to make 3 identical centerpieces. If they have 5 bunches of flowers, how many bunches of flowers can they use for each centerpiece?

13. There are 4 palm trees behind the shop. If the shop has 15 liters of water, how many liters of water can each tree receive?

14. Nadia wants to make a dress for each of her 4 dolls. She has 6 meters of fabric. She is confused about whether she can use  $\frac{2}{3}$  m of fabric for each dress or  $1\frac{1}{2}$  m of fabric for each dress. If she wants to use all fabric. Use numbers, words, or pictures to help explain how much fabric Nadia can use for each dress.

15. A school trip to the zoo consists of 4 teachers and 18 students, if the total of what the teachers paid is 30 L.E. and the total of what the students paid is 45 L.E. Find the price of the adult ticket and the price of the student ticket.



16. Write your own division story problems using two of the numbers for each problem. then, write an equation to solve each problem.

4      7      28

- Write a story problem in which the quotient is a whole number.
- Write a story problem in which the quotient is a fraction less than 1.
- Write a story problem in which the quotient is a mixed number.

## Multiple Choice Questions

Choose the correct answer.

1.  $12 \div 5$  equals each of the following except \_\_\_\_\_

A.  $\frac{5}{12}$       B.  $\frac{12}{5}$   
C.  $2\frac{2}{5}$       D.  $2 + \frac{2}{5}$

2. The missing fraction on the opposite division algorithm is \_\_\_\_\_

A.  $\frac{4}{14}$       B.  $\frac{4}{5}$   
C.  $\frac{5}{4}$       D.  $\frac{7}{2}$

$$\begin{array}{r} 2 \phantom{00} \\ 5 \overline{) 14} \\ \underline{- 10} \\ 4 \end{array}$$

3. If we divide 7 oranges among 5 persons, then each person has \_\_\_\_\_ orange.

A.  $\frac{5}{7}$       B.  $1\frac{1}{5}$   
C.  $2\frac{1}{5}$       D.  $1\frac{2}{5}$

4.  $6\frac{1}{2} = \text{_____} \div 2$

A. 11      B. 12  
C. 13      D. 14

5. All the following expressions equal each other except \_\_\_\_\_

A.  $22 \div 7$       B.  $7 \div 22$   
C.  $3\frac{1}{7}$       D.  $\frac{22}{7}$

6. If Sandy bought 5 kg of meat and wanted to divided it into 4 equally meals, then the number of kilograms in each meal = \_\_\_\_\_ kg

A.  $1\frac{1}{2}$       B.  $1\frac{1}{4}$   
C.  $1\frac{3}{4}$       D.  $1\frac{1}{8}$

7.  $12 \div 8 = 1\frac{1}{\text{_____}}$

A. 2      B. 3  
C. 4      D. 5

8.  $14 \div 5 = \text{_____} + 2$

A.  $\frac{2}{5}$       B.  $\frac{3}{5}$   
C.  $\frac{4}{5}$       D.  $\frac{1}{5}$

# 11&12

- Dividing Unit Fractions by Whole Numbers
- Dividing Whole Numbers by Unit Fractions

## Learn

Dividing unit fractions by whole numbers

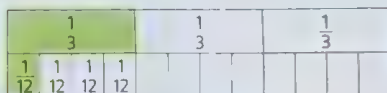
- Unit fraction is a fraction with 1 as the numerator.

To evaluate :  $\frac{1}{3} \div 4$

Rewrite the problem from division to multiplication :

$$\frac{1}{3} \div 4 = \frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$$

- Using area model



$$\frac{1}{3} \div 4 = \frac{1}{12}$$

Note that

Dividing  $\frac{1}{3}$  by 4

means  $\frac{1}{4}$  of  $\frac{1}{3}$

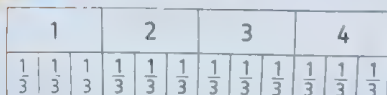
means  $\frac{1}{4} \times \frac{1}{3}$

To evaluate :  $4 \div \frac{1}{3}$

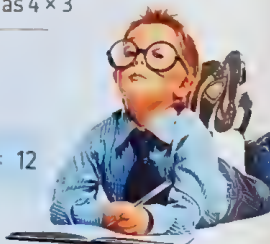
Rewrite the problem from division to multiplication

$$4 \div \frac{1}{3} = 4 \times 3 = 12$$

Using area model



There are 12 groups of  $\frac{1}{3}$  in 4, then  $4 \div \frac{1}{3} = 12$



## Example 1

Using area model to evaluate each of the following.

a.  $\frac{1}{5} \div 2$

b.  $\frac{1}{2} \div 7$

c.  $3 \div \frac{1}{4}$

d.  $6 \div \frac{1}{3}$

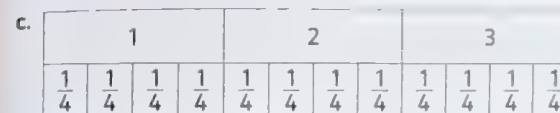
## Solution



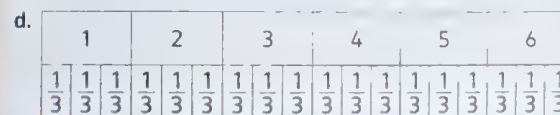
$$\frac{1}{5} \div 2 = \frac{1}{5} \times \frac{1}{2} = \frac{1}{10}$$



$$\frac{1}{2} \div 7 = \frac{1}{2} \times \frac{1}{7} = \frac{1}{14}$$



$$3 \div \frac{1}{4} = 3 \times 4 = 12$$



$$6 \div \frac{1}{3} = 6 \times 3 = 18$$

## Remark

- The relation between multiplication and division

If  $3 \times \frac{1}{3} = 1$ , then  $1 \div 3 = \frac{1}{3}$  and  $1 \div \frac{1}{3} = 3$



## Example 2

Find the quotient of each of the following.

a.  $\frac{1}{7} \div 3$

b.  $\frac{1}{2} \div 4$

c.  $\frac{1}{4} \div 4$

d.  $1 \div \frac{1}{5}$

e.  $3 \div \frac{1}{3}$

f.  $6 \div \frac{1}{5}$

### Solution

a.  $\frac{1}{7} \div 3 = \frac{1}{7} \times \frac{1}{3} = \frac{1}{21}$

b.  $\frac{1}{2} \div 4 = \frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$

c.  $\frac{1}{4} \div 4 = \frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$

d.  $1 \div \frac{1}{5} = 1 \times 5 = 5$

e.  $3 \div \frac{1}{3} = 3 \times 3 = 9$

f.  $6 \div \frac{1}{5} = 6 \times 5 = 30$

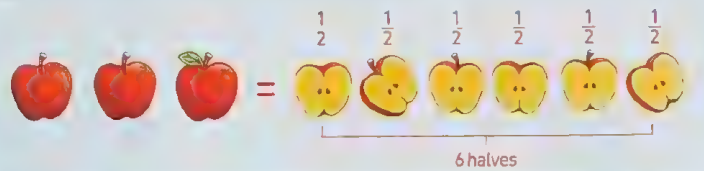
## Example 3

How many halves are there in 3 apples?

### Solution

To find the number of halves in 3 apples:

Divide each apple into 2 equal parts as in the following figure:



We can find the number of halves in 3 apples by dividing as follows:  $3 \div \frac{1}{2} = 3 \times 2 = 6$  halves

### Check your understanding

1. Evaluate each of the following using area model.

a.  $\frac{1}{4} \div 3$

b.  $2 \div \frac{1}{3}$

2. Find the quotient of each of the following.

a.  $5 \div \frac{1}{2} =$

b.  $7 \div \frac{1}{4} =$

c.  $\frac{1}{3} \div 6 =$

d.  $\frac{1}{6} \div 4 =$

## Exercise 13

on lessons 11&12

REMEMBER

UNDERSTAND

APPLY

PROBLEM SOLVING

From the school book

- Dividing Unit Fractions by Whole Numbers
- Dividing Whole Numbers by Unit Fractions

1. Using area models to dividing unit fractions and whole numbers to find the quotient.

a.  $\frac{1}{3} \div 5 =$

b.  $\frac{1}{2} \div 7 =$

c.  $\frac{1}{2} \div 3 =$

d.  $\frac{1}{8} \div 2 =$

e.  $\frac{1}{3} \div 2 =$

f.  $\frac{1}{6} \div 3 =$

g.  $\frac{1}{3} \div 4 =$

h.  $\frac{1}{5} \div 5 =$

i.  $4 \div \frac{1}{3} =$

j.  $3 \div \frac{1}{4} =$

k.  $3 \div \frac{1}{5} =$

l.  $4 \div \frac{1}{5} =$

m.  $5 \div \frac{1}{2} =$

n.  $8 \div \frac{1}{2} =$

o.  $2 \div \frac{1}{4} =$

p.  $6 \div \frac{1}{3} =$

2. Evaluate each of the following.

a.  $\frac{1}{2} \div 12$

b.  $\frac{1}{7} \div 5$

c.  $\frac{1}{8} \div 3$

d.  $\frac{1}{3} \div 7$

e.  $\frac{1}{5} \div 8$

f.  $\frac{1}{9} \div 4$

g.  $\frac{1}{9} \div 8$

h.  $\frac{1}{10} \div 2$

i.  $\frac{1}{12} \div 3$

j.  $7 \div \frac{1}{6}$

k.  $9 \div \frac{1}{2}$

l.  $10 \div \frac{1}{5}$

m.  $3 \div \frac{1}{9}$

n.  $12 \div \frac{1}{10}$

o.  $15 \div \frac{1}{2}$

p.  $16 \div \frac{1}{5}$

q.  $16 \div \frac{1}{4}$

r.  $100 \div \frac{1}{3}$

3. Write the missing number in each equation.

- |   |                                       |     |     |
|---|---------------------------------------|-----|-----|
| a. $\frac{1}{3} \div a = \frac{1}{12}$    | $\frac{1}{3} \times b = \frac{1}{12}$ | a = | b = |
| b. $\frac{1}{4} \div c = \frac{1}{20}$    | $\frac{1}{4} \times d = \frac{1}{20}$ | c = | d = |
| c. $\frac{1}{5} \div e = \frac{1}{30}$    | $\frac{1}{5} \times f = \frac{1}{30}$ | e = | f = |
| d. $\frac{1}{8} \div g = \frac{1}{24}$    | $\frac{1}{8} \times h = \frac{1}{24}$ | g = | h = |
| e. $\frac{1}{2} \times j = \frac{1}{14}$  | $\frac{1}{2} \div k = \frac{1}{14}$   | j = | k = |
| f. $\frac{1}{7} \times m = \frac{1}{21}$  | $\frac{1}{7} \div n = \frac{1}{21}$   | m = | n = |
| g. $\frac{1}{6} \div p = \frac{1}{12}$    | $\frac{1}{6} \times q = \frac{1}{12}$ | p = | q = |
| h. $\frac{1}{10} \times r = \frac{1}{40}$ | $\frac{1}{10} \div s = \frac{1}{40}$  | r = | s = |
| i. $5 \div a = 15$                        | $5 \times b = 15$                     | a = | b = |
| j. $8 \div c = 32$                        | $8 \times d = 32$                     | c = | d = |
| k. $3 \times f = 6$                       | $3 \div g = 6$                        | f = | g = |
| l. $6 \div h = 30$                        | $6 \times j = 30$                     | h = | j = |
| m. $8 \times k = 24$                      | $8 \div m = 24$                       | k = | m = |
| n. $7 \div n = 35$                        | $7 \times p = 35$                     | n = | p = |
| o. $3 \times q = 57$                      | $3 \div r = 57$                       | q = | r = |
| p. $9 \div s = 126$                       | $9 \times t = 126$                    | s = | t = |

4. Answer the following questions.

- How many halves are there in 7?
- How many fifths are there in 8?
- How many quarters are there in 6?
- How many sixths are there in 10?

??!!



Multiple Choice Questions

Choose the correct answer.

- $3 \div \frac{1}{3} = 8$   
A. > B. < C. =
- If  $\frac{1}{2} \div m = \frac{1}{16}$ , then  $m =$   
A. 8 B.  $\frac{1}{8}$   
C. 14 D.  $\frac{1}{14}$
- If  $7 \div a = 35$ , then  $a =$   
A. 5 B.  $\frac{1}{5}$   
C. 28 D.  $\frac{1}{7}$
- $4 \div \frac{1}{5} =$   
A.  $\frac{4}{5}$  B.  $\frac{1}{20}$   
C. 20 D.  $\frac{5}{4}$
- $\frac{1}{3} \div 5 \bigcirc \frac{1}{5} - \frac{2}{15}$   
A. > B. < C. =
- How many thirds are there in 9?  
A. 18 B. 27  
C. 36 D. 24
- $13 \div \frac{1}{4} =$   
A.  $\frac{13}{4}$  B.  $\frac{1}{52}$   
C. 17 D. 52
- $5 \div \frac{1}{4} \bigcirc 4 \div \frac{1}{5}$   
A. > B. < C. =
- The opposite area model represents  

$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$
$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$

  
A.  $\frac{1}{3} \div \frac{1}{6}$  B.  $\frac{1}{3} \div 2$   
C.  $\frac{1}{3} \div \frac{1}{2}$  D.  $\frac{1}{2} \times 3$
- The opposite area model represents  

$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$
$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$

  
A.  $\frac{1}{5} \div \frac{1}{10}$  B.  $\frac{1}{5} \div 2$   
C.  $\frac{1}{5} \div \frac{1}{2}$  D.  $\frac{1}{10} \div \frac{1}{5}$

Lesson  
13Story Problems Involving Division  
of Whole Numbers and Unit Fractions**Learn** What is the difference between  $5 \div \frac{1}{3}$  and  $\frac{1}{3} \div 5$ ?

- In  $5 \div \frac{1}{3}$  you need to find how many groups of  $\frac{1}{3}$  are in 5

$$\text{So, } 5 \div \frac{1}{3} = 15$$

- In  $\frac{1}{3} \div 5$  you need to divide  $\frac{1}{3}$  into 5 equal groups and determine how much is in one of those groups.

$$\text{So, } \frac{1}{3} \div 5 = \frac{1}{15}$$

**Example 1**

You plan to make a pizza party for your group of friends when half a pizza is divided into 3 equal parts, how much does each person get of a whole pizza?

**Solution**

$$\begin{aligned} \text{Each person have} &= \frac{1}{2} \div 3 = \frac{1}{2} \times \frac{1}{3} \\ &= \frac{1}{6} \text{ of pizza} \end{aligned}$$

**Example 2**

A computer takes  $\frac{1}{300}$  of a second to complete a math problem.

How many math problems can the computer answer in 90 seconds?

**Solution**

$$\begin{aligned} \text{The number of problems} &= 90 \div \frac{1}{300} \\ &= 27,000 \text{ problems} \end{aligned}$$

**Check** your understanding

- How many  $\frac{1}{3}$  cup servings are in 5 cups of chocolate?
- Four students sitting at a table were given  $\frac{1}{3}$  of a pan of brownies to share. How much of a pan will each student get if they share the pan of brownies equally?



## Story Problems Involving Division of Whole Numbers and Unit Fractions

- For each problem, identify which operation (addition, subtraction, multiplication, or division) should be used to model the situation described.
  - There are 4 kilograms of hummus. A worker separates the hummus into packages of  $\frac{1}{4}$  kg. How many packages will be made?
  - There are 4 bags of fava beans. Each bag has a mass of  $\frac{3}{4}$  of a kilogram. What is the total mass of the fava beans?
  - Gehad mixes  $\frac{1}{2}$  liter of blue paint with  $\frac{3}{8}$  litre of red paint to make a shade of purple paint. How many liters of purple paint does Gehad make?
  - Fatma feeds her cat  $\frac{1}{8}$  of a kilogram of cat food each day. How many days will 4 kg of cat food last?
  - Manal has  $2\frac{1}{2}$  hours to complete her schoolwork. She finishes her math in  $\frac{3}{4}$  of an hour. How much time remains for the rest of her schoolwork?
  - After the party,  $\frac{1}{5}$  of the food remains. Hoda gives  $\frac{1}{2}$  of the remaining food to her aunt. What fraction of the total amount of food did her aunt receive?
  - Nader has 8 liters of fruit juice. If he drinks  $\frac{1}{4}$  L of juice each day, how many days will it take him to finish all the juice?
  - The factory's staff is  $\frac{5}{8}$  female. How much of the staff is male?
- Read the given problems and compare the operation needed for each, identifying the values and their meanings. Then, apply your strategies to solve both problems.
  - On Tuesday morning, Farha's Flower Shop made 7 bouquets of daffodils which were  $\frac{1}{5}$  of the number of bouquets ordered for that day. How many total bouquets were ordered from Farha's Flower Shop on Tuesday?
  - Aya's Floral Shop has 7 liters of special water to use for bouquets of myrtles. Each bouquet requires  $\frac{1}{5}$  of a liter of the special water. How many bouquets can Aya's Floral Shop make?
- I took ten minutes to answer one-quarter of the questions on my mathematics test.  
How long will it take to answer all the questions on my mathematics test?



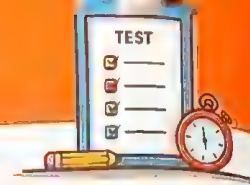
- A Walmart employee is a shelf stacker. His time for stacking a shelf is  $\frac{1}{3}$  hour for a shelf. If he is at work for 8 hours. How many shelves will he be able to fill?

- You have 24 big yo-yos that you would like to paint green. Each yo-yo takes half a cup to paint. You have 8 cups of paint. How many yo-yos can you paint? then find the number of yo-yos that not painting.



- Select the expression that represents the problem, and then evaluate it.

- If a turtle can crawl  $\frac{1}{2}$  kilometers per hour, how many hours would it take for the turtle to travel 8 km?  
Choose:  $\frac{1}{2} \div 8$  or  $8 \div \frac{1}{2}$
- A teacher wants to give  $\frac{1}{8}$  of a box of pencils to each student. She has 5 boxes of pencils. To how many students will she be able to give pencils?  
Choose:  $\frac{1}{8} \div 5$  or  $5 \div \frac{1}{8}$
- Abdallah has 3 identical gifts to wrap. He uses  $\frac{1}{2}$  of a roll of paper to wrap the gifts. If each gift uses the same amount of paper, how much paper did Abdallah use for each gift?  
Choose:  $\frac{1}{2} \div 3$  or  $3 \div \frac{1}{2}$
- Afaf and Adel pulled up weeds in  $\frac{1}{6}$  of the garden's area. If they divided the weeding equally, what total area of the garden did Afaf weed?  
Choose:  $\frac{1}{6} \div 2$  or  $2 \div \frac{1}{6}$
- A toddler eats  $\frac{1}{3}$  of a piece of bread each day for breakfast. If the loaf of bread contains 12 pieces, how many days of breakfast will the loaf of bread provide?  
Choose:  $\frac{1}{3} \div 12$  or  $12 \div \frac{1}{3}$
- A computer takes  $\frac{1}{200}$  of a second to complete a math problem. How many math problems can the computer answer in 120 seconds?  
Choose:  $\frac{1}{200} \div 120$  or  $120 \div \frac{1}{200}$
- A box of dry milk powder contains 15 servings. The box of milk powder weighs  $\frac{1}{2}$  of a kilogram. What is the weight of each serving of dry milk powder?  
Choose:  $\frac{1}{2} \div 15$  or  $15 \div \frac{1}{2}$
- It takes Aya  $\frac{1}{3}$  of an hour to model 4 identical clay figures. How long does it take for Aya to model one clay figure? Choose:  $\frac{1}{3} \div 4$  or  $4 \div \frac{1}{3}$



## 1. Choose the correct answer.

a.  $\frac{1}{6} \div 3$

A. &gt;

B. &lt;

C. =

b.  $2\frac{3}{4} \times \text{---} = 1$

A.  $\frac{4}{11}$ 

B.  $\frac{11}{4}$ 

C. 4

D.  $\frac{4}{3}$ 

c.  $(4 \times 2) + (4 \times \frac{2}{7}) + (\frac{1}{3} \times 2) + (\frac{1}{3} \times \frac{2}{7}) =$

A.  $4\frac{2}{7} \times 2\frac{1}{3}$ 

B.  $4\frac{1}{3} \times 2\frac{2}{7}$ 

C.  $3\frac{1}{4} \times 2\frac{2}{7}$ 

D.  $4\frac{3}{7} \times 3\frac{2}{3}$ 

d.  $0.25 \times \frac{6}{7} =$

A.  $\frac{1}{14}$ 

B.  $\frac{1}{7}$ 

C.  $\frac{3}{14}$ 

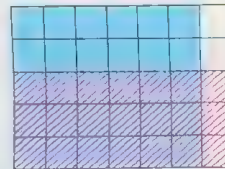
D.  $\frac{2}{7}$ 

e. The opposite model represents -

A.  $\frac{2}{5} \times \frac{7}{6}$ 

B.  $\frac{2}{7} \times \frac{5}{6}$ 

C.  $\frac{2}{5} \times \frac{3}{7}$ 

D.  $\frac{3}{5} \times \frac{6}{7}$ 


f.  $2\frac{2}{3} \times \frac{3}{5} =$

A.  $\frac{5}{8}$ 

B.  $1\frac{3}{5}$ 

C.  $1\frac{8}{15}$ 

D.  $2\frac{6}{15}$ 

g.  $7 \div \frac{1}{2} =$

A.  $3\frac{1}{2}$ 

B. 3

C. 14

D. 16

## 2. Complete.

a.  $\frac{3}{8} \times \frac{5}{8} = \frac{15}{56}$

c.  $\frac{3}{4} - \frac{5}{8} = \text{---} \div 4$

e.  $\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \frac{5}{6} \times \frac{6}{7} = \text{---}$

g.  $3 \div \frac{1}{5} =$

b. If  $9 \div K = 126$ , then  $K =$  ---

d.  $25 \div 6 = 2\frac{1}{2} \times 1\frac{---}{3}$

f. If  $\frac{1}{3} \div m = \frac{1}{12}$ , then  $m =$

h.  $\frac{2}{5} \times 2\frac{1}{2} =$

## 3. Choose the correct answer.

a.  $7\frac{1}{7} \times \frac{9}{8}$

A. &gt;

B. &lt;

C. =

b. If  $\frac{6}{23} \times a = \frac{6}{23} + \frac{6}{23} + \frac{3}{23}$ , then  $a =$

A.  $1\frac{1}{2}$ 

B. 2

C.  $2\frac{1}{2}$ 

D. 3

c. If  $6 \div h = 30$ , then  $h =$

A.  $\frac{1}{5}$ 

B. 180

C. 5

D. 90

d.  $3 \times \frac{1}{3}$

A. &gt;

B. &lt;

C. =

e.  $1\frac{1}{3} \times 1\frac{1}{4} =$

A.  $1\frac{2}{3}$ 

B.  $2\frac{1}{7}$ 

C.  $2\frac{1}{12}$ 

D.  $1\frac{1}{12}$ 

f.  $\frac{1}{7} \times m = \frac{1}{21}$ , then  $m =$

A.  $\frac{1}{7}$ 

B.  $\frac{1}{21}$ 

C.  $\frac{1}{3}$ 

D.  $\frac{1}{147}$ 

g.  $\frac{5}{3} \times 21 \times \frac{2}{7} =$

A.  $\frac{24}{35}$ 

B.  $\frac{21}{21}$ 

C. 1

D. 10

## 4. Answer the following.

a. Sandy eats  $\frac{1}{3}$  of a piece of bread each day for breakfast. If the loaf of bread contains 9 pieces. How many days of breakfast will the loaf of bread provide?

b. Mariam is reading a chapter book. She can usually read  $7\frac{1}{3}$  pages in one hour. If she plans to read for two hours and 15 minutes. How many pages will she read?

c. A teacher wants to give  $\frac{1}{4}$  of a box pencils to each student. He has 6 boxes of pencils. To how many students will he be able to give pencils?

d. Write the result in its simplest form.

1.  $\frac{3}{5} \times 1.5$

2.  $\frac{1}{5} \div 4$

3.  $2\frac{1}{2} \times 4\frac{2}{5}$

4.  $3 \div \frac{1}{8}$

# UNIT 10

## Two-Dimensional Plane Figures and Coordinate Planes

» **Concept 1** : Investigating Attributes of Shapes

» **Concept 2** : Coordinate Planes

### Did You Know?!

Honeybees store their honey in the small cells in the shape of *hexagons*.

## Concept 1

## Investigating Attributes of Shapes

### Did You Know?!

This modern office building in Hamburg, Germany is in the shape of parallelogram!



Lesson No.	Lesson Name	Learning Objectives
Lesson 1	Categories of Shapes	<ul style="list-style-type: none"> <li>Students will classify two-dimensional figures into categories based on their attributes</li> <li>Students will classify two-dimensional figures into categories and subcategories based on their attributes</li> <li>Students will explain how two figures can belong to more than one subcategory</li> </ul>
Lesson 2	Tricky Triangles	<ul style="list-style-type: none"> <li>Students will measure the sides of triangles</li> <li>Students will categorize triangles based on their properties</li> </ul>
Lessons 3 to 5	Using Tiling to Calculate Area	<ul style="list-style-type: none"> <li>Students will use tiling to find the area of rectangles with whole number and fractional dimensions</li> </ul>
	Calculating Area with Fractional Dimensions	<ul style="list-style-type: none"> <li>Students will draw models to find the area of rectangles with whole-number and fractional dimensions</li> </ul>
	Applying the Area Formula	<ul style="list-style-type: none"> <li>Students will multiply to find the area of rectangles with whole-number and fractional dimensions</li> </ul>

## Categories of Shapes

### Remember

Parallel lines



Perpendicular lines



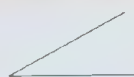
Intersecting lines



Right angle



Acute angle



Obtuse angle



A polygon



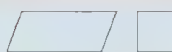
Triangle



A quadrilateral



A parallelogram



Pentagon



Hexagon



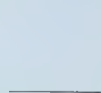
### Check your understanding

1. Write the type of each angle.

a.



b.



c.



2. Write the relation between 2- straight lines.

a.



b.



c.



## Learn Quadrilateral

Quadrilateral is a polygon with four sides.

You will study some quadrilaterals as the following.



square

All sides have the same length, the four angles are right.



Rectangle

The opposite sides are parallel and have the same length, the four angles are right.

### Remember

- Parallel lines do not meet.
- Right angles form square corners



Some quadrilaterals do not have four right angles.



Parallelogram

It has two pairs of parallel sides.



Rhombus

It has two pairs of parallel sides, 2 acute and 2 obtuse angles. It has four congruent sides.



Trapezoid or Trapezium

It has only one pair of parallel sides.



Kite

Each two pairs of adjacent sides are congruent.

### Note that

- All of square, rectangle and rhombus are a parallelogram because they all have both pairs of opposite sides parallel.
- The subcategory between square and rectangle, they have 4 right angles.
- The subcategory between square and rhombus, they have 4 sides equal in length.

### Example

Choose the quadrilaterals match the descriptions below.

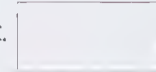
A.



B.



C.



D.



E.



- Which of the figures have four right angles?
- Which of the figures have four sides of the same length?
- Which shapes are parallelograms? Why?

### Solution

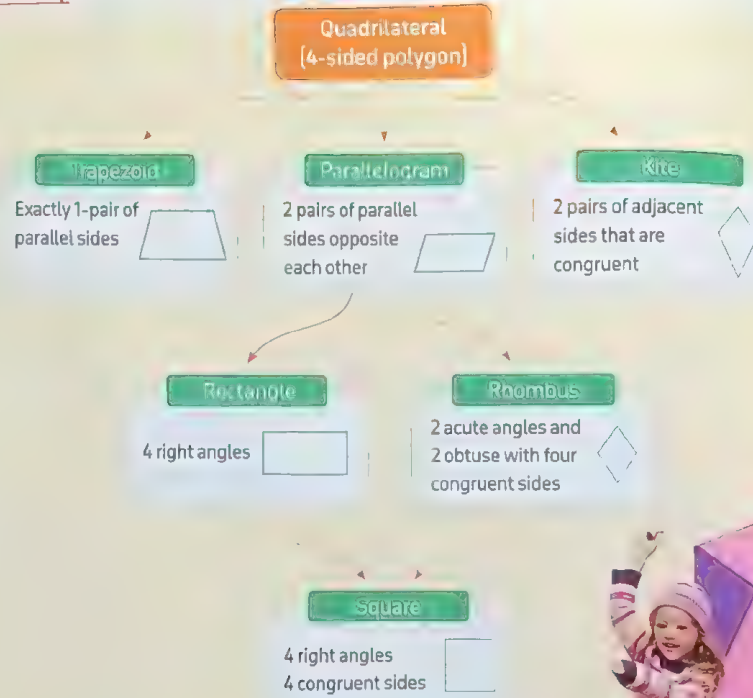
a. A, C

b. A, D

c. A, B, C, D

They all have two pairs of opposite parallel sides.

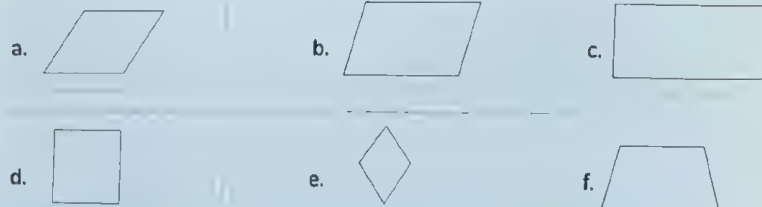
## Summary



- The parallelogram with right angle is called rectangle.
- The parallelogram with four congruent sides is called rhombus.
- The rectangle with 4-sides equal in length is called square.
- The rhombus with 4 right angles is called square.

 **Check** your understanding

Write the name that best describes each figure.



## Exercise 15

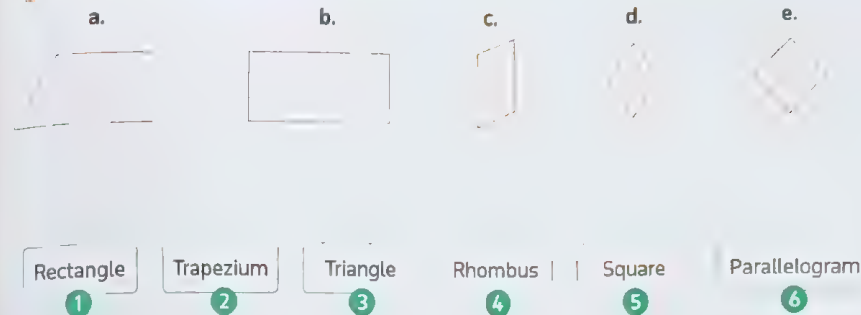
on lesson 1

REMEMBER UNDERSTAND APPLY PROBLEM SOLVING

From the school book

## Categories of Shapes

1. Join each figure to its name.



2. Complete.

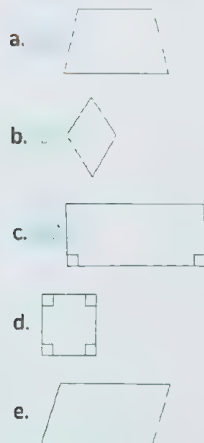
- The polygon which has four sides is called \_\_\_\_\_
- The polygon which has only two parallel sides is called \_\_\_\_\_
- Each two opposite sides are parallel in \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_
- The four sides are equal in length in \_\_\_\_\_ and \_\_\_\_\_
- The four angles are right in \_\_\_\_\_ and \_\_\_\_\_
- In the square, all angles are \_\_\_\_\_ angles.
- The parallelogram with 4-right angles is called \_\_\_\_\_
- The parallelogram with 4-side are equal in length is called \_\_\_\_\_
- The rectangle with 4-sides are equal in length is called \_\_\_\_\_
- The rhombus with 4-right angles is called \_\_\_\_\_

3. Put (✓) to the correct statement and (X) to the incorrect statement.

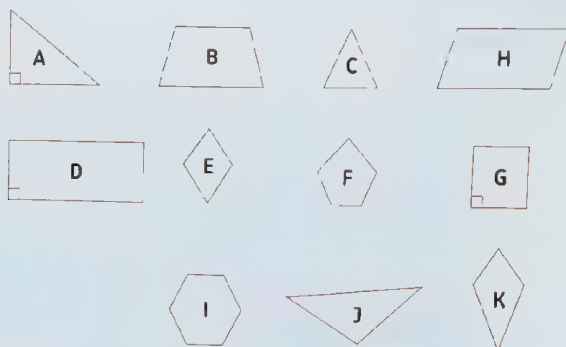
- The sides of the square are equal in length. [      ]
- The angles of the rectangle are right. [      ]

- c. The opposite sides in the parallelogram are parallel. {
- d. The rhombus has only one pair of parallel sides. {
- e. The measure of any angle of the square =  $45^\circ$  {
- f. The kite is a parallelogram with two pairs of adjacent sides are equal in length. {

4. Write the name, then describe the attributes of the following shapes.



5. Classify the following shapes using a Venn diagram to place the polygons into the Venn diagram. Some shapes may be placed outside the circles.



Shapes with Acute Angles      Shapes with Obtuse Angles



More Categorizing Shapes. Answer the questions.

- a. What subcategory could shapes A and D share?
- A. Quadrilaterals      B. Parallel sides  
C. Right angles      D. Obtuse angles
- b. Which of the subcategories could include shapes D and G?
- A. Four right angles      B. Quadrilaterals  
C. Parallel sides      D. Perpendicular sides  
E. All of the above

6. Use the list of quadrilaterals to fill in the chart.

Remember that the hierarchy goes from most general to more specific.

Rectangle      Parallelogram      Rhombus      Square      Trapezium      Kite

Quadrilateral  
[4-sided polygons]

	1.	2.	3.
Types of sides	Exactly 1-pair of parallel sides	2 pairs of parallel sides opposite each other	2 pairs of adjacent sides that are congruent
Types of angles	4.  4 right angles	5.  2 acute angles and 2 obtuse with four congruent sides	6.  4 right angles 4 congruent sides

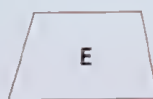
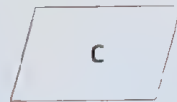
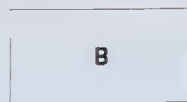
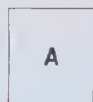
7. Mostafa is making a design using a quadrilateral that has four equal sides and four same-sized angles. What shape is he using?

8. Paula is making a design using a quadrilateral that has two pairs of parallel sides with all sides the same length but with no right angles. What shape is he using?

9. You are making a design using a quadrilateral with only one pair of parallel sides. What shape could you use?

### Challenge

10. Match the quadrilaterals with each description below.



- Which of the figures are rectangles? —
- Which of the figures have four right angles? —
- Which of the figures have four sides all the same length?
- Which shapes are parallelograms? Explain how you made your decision.

### Multiple Choice Questions

Choose the correct answer.

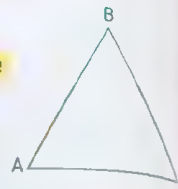
- The polygon which has 3-sides is called  
A. square B. quadrilateral C. triangle D. hexagon
- The parallelogram with four right angles is called  
A. trapezoid B. kite C. rhombus D. square
- The quadrilateral which has 2 pairs of parallel sides opposite each other is  
A. parallelogram B. kite C. trapezoid D. triangle
- The quadrilateral which all sides are the same length and all angles are right angles is  
A. rectangle B. square C. parallelogram D. rhombus
- You are making a design using a quadrilateral with 2 pairs of parallel sides but no right angles. What shape could you use?  
A. Rectangle B. Rhombus C. Trapezoid D. Kite
- The four sides are equal in length in square and  
A. Rectangle B. Rhombus C. Parallelogram D. Trapezoid
- The four angles are equal in measure in square and  
A. rectangle B. rhombus C. parallelogram D. trapezoid
- Which of the following is a parallelogram?  
A. Trapezoid B. Rectangle C. Triangle D. Kite
- The rectangle which has two adjacent sides are equal in length is called  
A. Rhombus B. Kite C. Parallelogram D. Square
- The rhombus which has right angles is called  
A. rectangle B. trapezoid C. square D. pentagon

Lesson  
2

## Tricky Triangles

## Learn

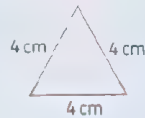
Triangles are three-sided **polygons**. Each side is a **line segment**. They are named by their vertices. Triangle ABC is formed with line segments  $\overline{AB}$ ,  $\overline{BC}$ , and  $\overline{CA}$ .



You can classify triangles by the lengths of their sides.

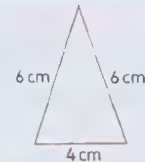
## Types of triangles according to the lengths of their sides

## 1. Equilateral triangle



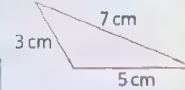
- Its three sides are equal in length.

## 2. Isosceles triangle



- Two of its sides are equal in length.

## 3. Scalene triangle

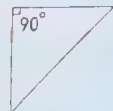


- Its three sides are different in length.

You can also classify by the measures of their angles.

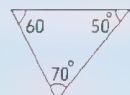
## Types of triangles according to the measures of their angles

## 1. Right-angled triangle



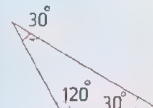
- One of its angles is right angle [Its measure equals  $90^\circ$ ].
- Each of the two other angles is an acute angle.

## 2. Acute-angled triangle



- Each of its three angles is acute angle. [Its measure is less than  $90^\circ$ ].

## 3. Obtuse-angled triangle



- One of its angles is obtuse angle [Its measure is greater than  $90^\circ$ ].
- Each of the two other angles is acute angle.

How to identify the type of a given triangle according to the measures of its angles?

## The types of triangles according to the measures of its angles

## 1. A right angle



- Then the triangle is a right-angled triangle.

## 2. An acute angle



- Then the triangle is an acute-angled triangle.

## 3. An obtuse angle



- Then the triangle is an obtuse-angled triangle.

## Example 1

Label the angles of each triangle. In each angle, place an A for acute, O for obtuse and R for right and write the type of each triangle according to the measures of its angles.

a.



b.



c.

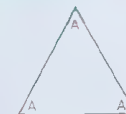


d.



## Solution

a.



An acute-angled triangle

b.



An obtuse-angled triangle

c.



An acute-angled triangle

d.



A right-angled triangle

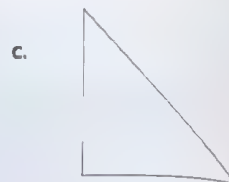
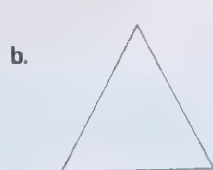
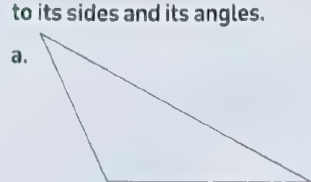
## Remarks

- 1 It is impossible to draw a triangle with two obtuse angles or two right angles because the sides will never close to form a triangle.
- 2 Any triangle has at least two acute angles.

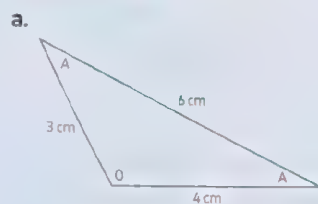


## Example 2

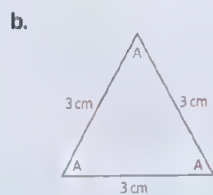
Measure and label each triangle. Then classify each triangle according to its sides and its angles.



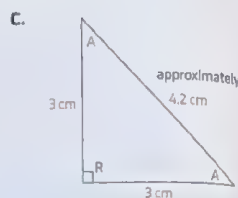
### Solution



Scalene triangle,  
obtuse-angled triangle



Equilateral triangle,  
acute-angled triangle



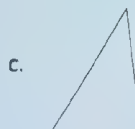
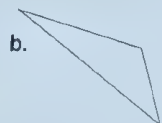
Isosceles triangle,  
right-angled triangle

### Check your understanding

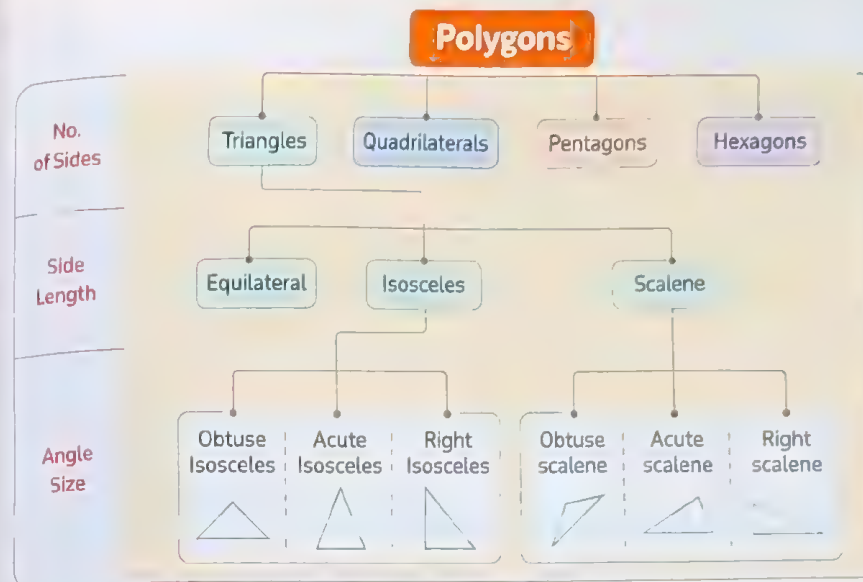
1. Classify each triangle as equilateral, isosceles, or scalene.



2. Classify each triangle as acute, right, or obtuse.



You can add triangle information to the Polygon Anchor Chart.



## Exercise

## 16

on lesson 2

REMEMBER

UNDERSTAND

APPLY

PROBLEM SOLVING

From the school book

## Tricky Triangles

1. Determine the type of each of the following triangles given the measures of their angles.

- a.  $m(\angle E) = 30^\circ$ ,  $m(\angle F) = 90^\circ$  and  $m(\angle G) = 60^\circ$  " \_\_\_\_\_ -angled triangle"
- b.  $m(\angle I) = 30^\circ$ ,  $m(\angle J) = 40^\circ$  and  $m(\angle K) = 110^\circ$  " \_\_\_\_\_ -angled triangle"
- c.  $m(\angle S) = 51^\circ$ ,  $m(\angle T) = 67^\circ$  and  $m(\angle U) = 62^\circ$  " \_\_\_\_\_ -angled triangle"
- d.  $m(\angle L) = 32^\circ$ ,  $m(\angle N) = 58^\circ$  and  $m(\angle M) = 90^\circ$  " \_\_\_\_\_ -angled triangle"
- e.  $m(\angle X) = 46^\circ$ ,  $m(\angle Y) = 38^\circ$  and  $m(\angle Z) = 96^\circ$  " \_\_\_\_\_ -angled triangle"
- f.  $m(\angle H) = m(\angle B) = 70^\circ$  and  $m(\angle A) = 40^\circ$  " \_\_\_\_\_ -angled triangle"
- g.  $m(\angle A) = m(\angle B) = 45^\circ$  and  $\angle C$  is a right angle. " \_\_\_\_\_ -angled triangle"

2. Determine the type of the triangles according to their side lengths using the following data.

- a.  $AB = 6.5$  cm,  $BC = 7$  cm and  $CA = 6.5$  cm " \_\_\_\_\_ triangle"
- b.  $XY = 4.5$  cm,  $YZ = 8$  cm and  $ZX = 5.5$  cm " \_\_\_\_\_ triangle"
- c.  $NO = 4.5$  cm,  $OR = 4.5$  cm and  $RN = 4.5$  cm " \_\_\_\_\_ triangle"
- d.  $MA = AY = 9$  cm and  $YM = 10$  cm " \_\_\_\_\_ triangle"
- e.  $AM = 10$  cm,  $MR = 7$  cm and  $RA = \frac{1}{2} AM$  " \_\_\_\_\_ triangle"

3. Complete.

- a. The triangle is a polygon that has \_\_\_\_\_ sides and \_\_\_\_\_ angles.
- b. The equilateral triangle is a triangle whose sides are \_\_\_\_\_.
- c. Any triangle has at least \_\_\_\_\_ acute angles.
- d. The triangle ABC is an equilateral triangle where  $AB = 5$  cm, then



4. put (✓) to the correct statement and (X) to the incorrect statement.

- a. There can be two right angles in one triangle. [ ]
- b. There can be three acute angles in one triangle. [ ]
- c. All the angles of the obtuse-angled triangle are obtuse. [ ]
- d. There can be a right angle and an obtuse angle in one triangle. [ ]
- e. It is possible to draw a triangle with two obtuse angles. [ ]
- f. There can be an equilateral triangle that is also a scalene triangle. [ ]
- g. There can be an obtuse triangle that is also isosceles triangle. [ ]
- h. There can be a right triangle that is also scalene triangle. [ ]

5. Identify Triangle Types Using Measurement. Measure and label each triangle.

Then, select the best name for each triangle based on its properties.  
Some triangles may be classified in more than one way.



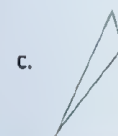
a. What two types of triangles are shown?

- A. scalene triangle      D. right triangle  
B. isosceles triangle      E. acute triangle  
C. equilateral triangle      F. obtuse triangle



b. Which two types of triangles are shown?

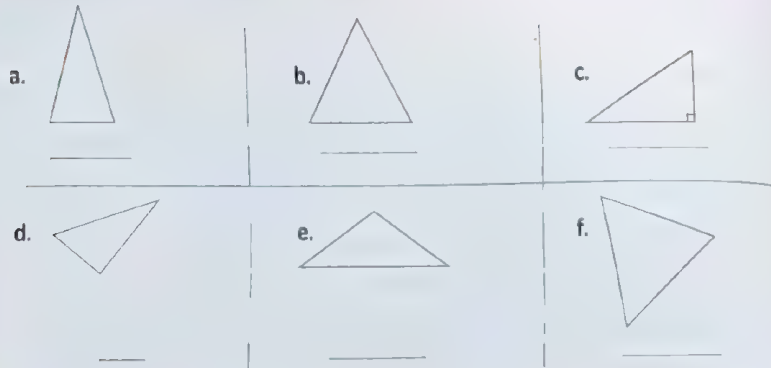
- A. scalene triangle      D. right triangle  
B. isosceles triangle      E. acute triangle  
C. equilateral triangle      F. obtuse triangle



c. Which two types of triangles are shown?

- A. scalene triangle      D. right triangle  
B. isosceles triangle      E. acute triangle  
C. equilateral triangle      F. obtuse triangle

6. Classify each triangle by its sides and angles.



### Challenge

7. Draw the next figure in each pattern. Then classify the new triangle in the pattern by the length of its sides and the measure of its angles.

Key : E = equilateral , I = isosceles , S = scalene

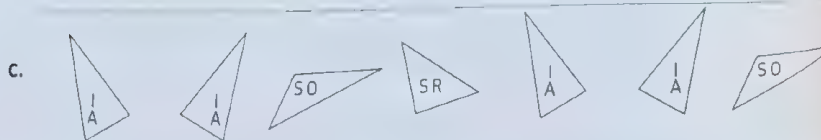
R = right , A = acute , O = obtuse



Look for continuation of pattern.



Look for continuation of pattern.



Look for continuation of pattern.

### Multiple Choice Questions

Choose the correct answer.

- If the side lengths of a triangle are different, then the triangle is called \_\_\_\_\_ triangle.  
A. equilateral B. isosceles C. scalene
- The triangle whose side lengths are 7 cm, 4 cm and 7 cm is called \_\_\_\_\_ triangle.  
A. equilateral B. isosceles C. scalene
- The triangle whose side lengths are 8 cm, 6 cm and \_\_\_\_\_ cm is called scalene triangle.  
A. 8 B. 6 C. 7
- $50^\circ$ ,  $70^\circ$  and  $60^\circ$  are the measures of the angles of \_\_\_\_\_ triangle.  
A. an obtuse-angled B. a right-angled C. an acute-angled
- The triangle whose side lengths are \_\_\_\_\_ is an equilateral triangle.  
A. 7 cm, 6 cm, 7 cm B. 5 cm, 5 cm, 5 cm  
C. 5 cm, 6 cm, 7 cm D. 3 cm, 4 cm, 4 cm
- The triangle whose measures of angles are  $40^\circ$ ,  $50^\circ$  and \_\_\_\_\_ is right-angled triangle.  
A.  $50^\circ$  B.  $40^\circ$  C.  $90^\circ$  D.  $180^\circ$
- The triangle whose measures of angles are \_\_\_\_\_ is an obtuse-angled triangle.  
A.  $30^\circ$ ,  $100^\circ$ ,  $50^\circ$  B.  $30^\circ$ ,  $60^\circ$ ,  $90^\circ$  C.  $70^\circ$ ,  $80^\circ$ ,  $30^\circ$  D.  $50^\circ$ ,  $80^\circ$ ,  $50^\circ$
- The opposite triangle is \_\_\_\_\_.  
A. acute B. right  
C. obtuse D. equilateral
- The opposite triangle is \_\_\_\_\_.  
A. equilateral B. isosceles  
C. scalene D. obtuse
- I am a triangle with only 2 equal sides, the measure of one of my angles is greater than  $90^\circ$ .  
What kind of triangle am I?  
A. isosceles, right B. isosceles, obtuse C. scalene, obtuse D. isosceles, acute

# Lessons 3 to 5

- Using Tiling to Calculate Area
- Calculating Area with Fractional Dimensions
- Applying the Area Formula

## Learn 1 Using tiling to calculate area

How to find the area of rectangle by counting the number of equal units which the figure consists.

### Example 1

Count the unit tiles to determine the area of the opposite rectangle.

#### Solution

Number of unit tiles = area of rectangle  
= 24 tiles (square units)



We can find area of rectangle by using  
the rule =  $L \times W$   
=  $6 \times 4 = 24$  tiles (square units)

### Example 2

Draw a rectangle with an area 12 square units.

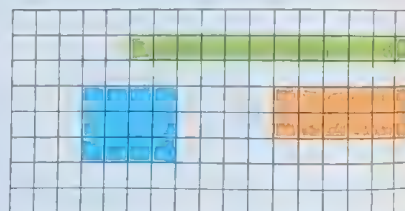
#### Solution

To draw a rectangle of  
area 12 square units, we  
find factors of 12 as :

$$1 \times 12 = 12$$

$$2 \times 6 = 12$$

$$3 \times 4 = 12$$



We can draw a rectangle of dimensions are  
1 unit and 12 units or 2 units and 6 units or 3 units and 4 units

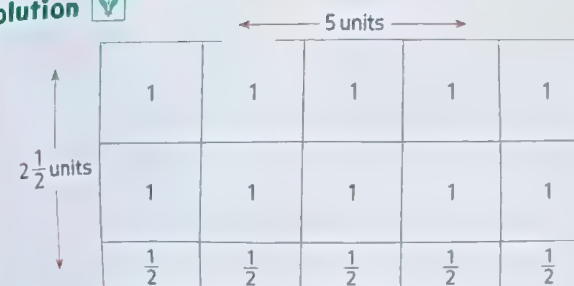
## Learn 2 Tiling with fractional dimensions

How to draw and find area of a rectangle with fractional dimensions.

### Example 3

Draw a rectangle with dimensions 5 units and  $2\frac{1}{2}$  units, then calculate its area.

#### Solution



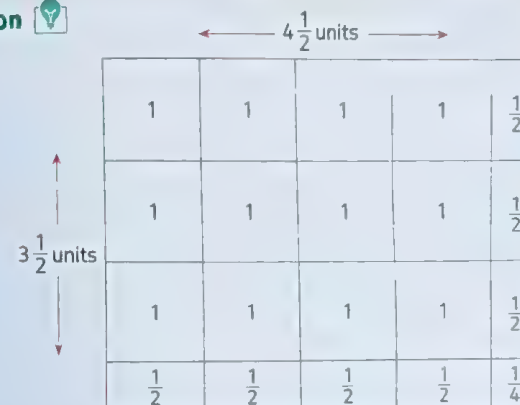
**Note that**  
Area of  
rectangle =  
number of squares  
which formed the  
rectangle

$$\text{Area} = [5 \times 2] + [5 \times \frac{1}{2}] = 10 + 2\frac{1}{2} = 12\frac{1}{2} \text{ square units.}$$

### Example 4

Draw a rectangle with dimensions  $4\frac{1}{2}$  units and  $3\frac{1}{2}$  units, then calculate its area.

#### Solution



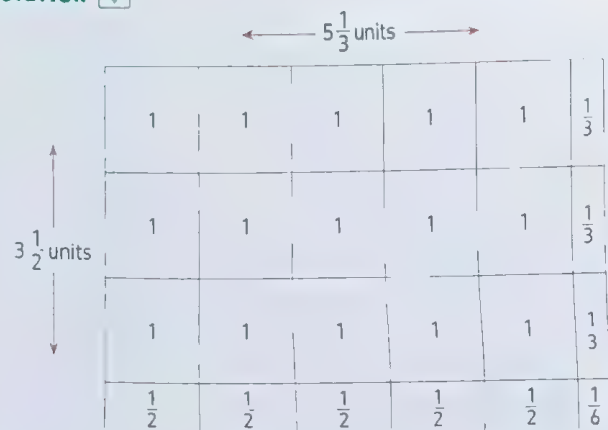
$$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

$$\text{Area} = [4 \times 3] + [7 \times \frac{1}{2}] + [1 \times \frac{1}{4}] = 12 + 3\frac{1}{2} + \frac{1}{4} = 15\frac{3}{4} \text{ square units}$$


### Example 5

Draw a model for a rectangle measuring  $5\frac{1}{3}$  meters by  $3\frac{1}{2}$  meters, then find its area.

**Solution** 



$$\text{Area} = [5 \times 3] + [5 \times \frac{1}{2}] + [3 \times \frac{1}{3}] + [1 \times \frac{1}{6}] = 15 + 2\frac{1}{2} + 1 + \frac{1}{6} = 18\frac{2}{3} \text{ square meters.}$$

 **Check** your understanding

Draw a model for a rectangle measuring  $2\frac{3}{4}$  meters by  $3\frac{1}{2}$  meters, then find its area.

### Learn 3 Modeling area with fractions

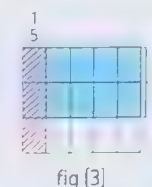
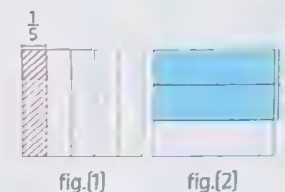
How to model rectangles with fractional dimensions.


### Example 6

Draw a model for a rectangle of dimensions are  $\frac{1}{5}$  units and  $\frac{2}{3}$  units and find its area.

**Solution** 

- Draw a rectangular model of  $\frac{1}{5}$  vertically as fig. [1]
- Draw a rectangular model of  $\frac{2}{3}$  horizontally as fig. [2]
- Imagine the two models if one of them above the other.
- Redraw the models using one rectangle.
- Divide the rectangle vertically into fifths and horizontally into thirds as fig. [3]
- The area of required rectangle is shown where shaded overlaps.
- We have [2 out of 15] overlapping shaded, then area of rectangle =  $\frac{2}{15}$  square units.



 **Check** your understanding

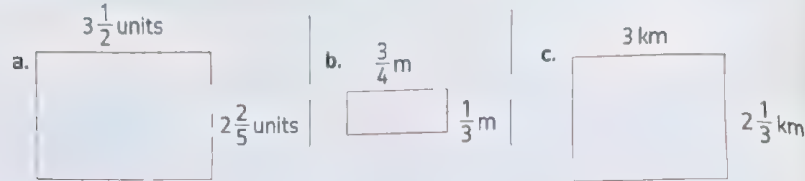
Draw a model for a rectangle of dimensions are  $\frac{3}{4}$  units and  $\frac{2}{5}$  units, then find its area.

# Learn 4 Applying the area formula

You can find area of rectangle by using formula:  $A = L \times W$

## Example 7

Find the area of the following rectangles.



## Solution

a.  $\text{Area} = L \times W = 3\frac{1}{2} \times 2\frac{2}{5} = \frac{7}{2} \times \frac{12}{5} = \frac{42}{5} = 8\frac{2}{5}$  square units

b.  $\text{Area} = L \times W = \frac{3}{4} \times \frac{1}{3} = \frac{1}{4}$  m<sup>2</sup>

"There are another way mathematicians write square units is by putting an exponent 2 above the unit as m<sup>2</sup> or cm<sup>2</sup> and so on."

c.  $\text{Area} = L \times W = 3 \times 2\frac{1}{3} = 3 \times \frac{7}{3} = 7$  km<sup>2</sup>

### Note that

You can use any strategy to find the result of product.

## Example 8

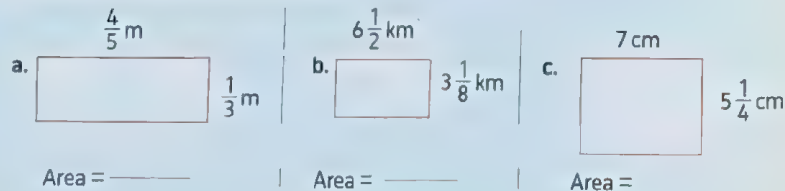
Ahmed has a garden of length 8 meters and width  $\frac{2}{3}$  meter. What is the area of Ahmed's garden?

## Solution

$A = L \times W = 8 \times \frac{2}{3} = \frac{16}{3} = 5\frac{1}{3}$  m<sup>2</sup>

## Check your understanding

Find area of the following rectangles.



## Exercise 17

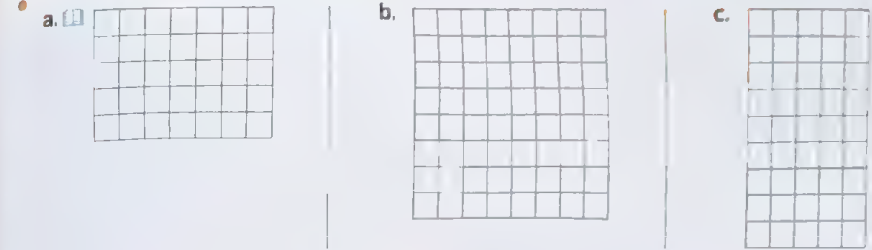
on lessons 3 to 5

REMEMBER UNDERSTAND APPLY PROBLEM SOLVING

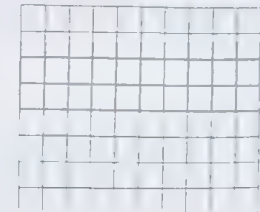
From the school book

- Using Tiling to Calculate Area
- Calculating Area with Fractional Dimensions
- Applying the Area Formula

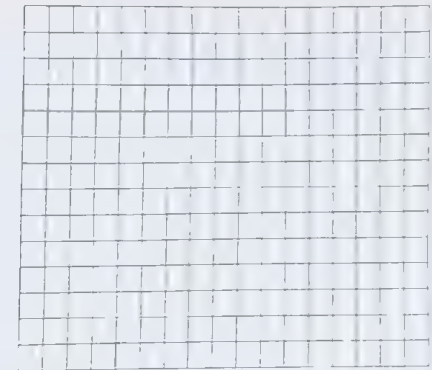
1. Count the unit tiles to determine the area of each rectangle.



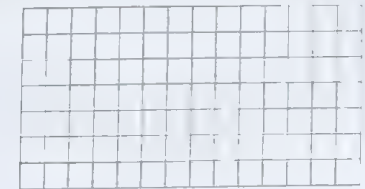
2. Draw a rectangle with a length of 8 units and width 5 units, then find its area.



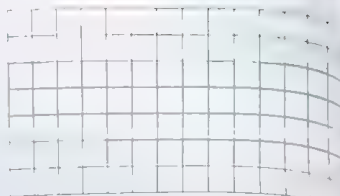
3. Draw a rectangle with a length of 15 units and a width of 12 units, then find its area.



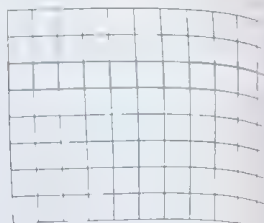
4. Draw a rectangle with an area of 12 square units.



5. Draw a rectangle with an area of 24 square units.



6. Draw a rectangle with an area of 30 square units.

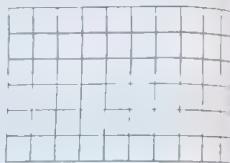


7. Find the area of the rectangle below by tiling (sketching in the unit square).

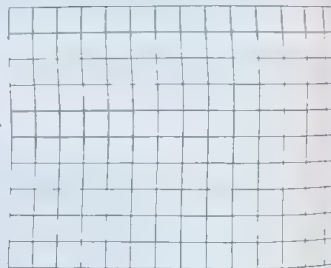


8. Answer the following.

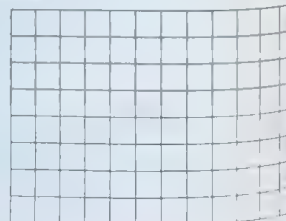
- a. Draw a rectangle with dimensions  $4\frac{1}{2}$  units  $\times$   $2\frac{1}{2}$  units, then, calculate and record its area. Be sure to label your answer.



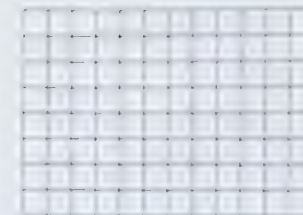
- b. Draw a rectangle with dimensions of  $6\frac{1}{2}$  units  $\times$   $4\frac{1}{2}$  units. Then, calculate and record its area. Be sure to label your answer.



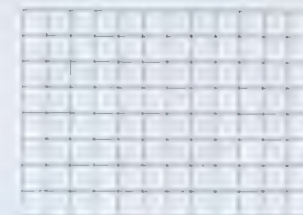
- c. Doha is tiling her  $4 \times 6\frac{1}{2}$ -unit bathroom. The tiles come in 1-unit squares. How many tiles will she need to cover the floor? Model your thinking.



- d. Amir measures a painting. It is  $4\frac{1}{3}$  units long by  $2\frac{1}{2}$  units wide. Draw a model of the painting. Be prepared to complete the problem with your class.



- e. Draw a model for a rectangle measuring  $9\frac{1}{4}$  meters by  $3\frac{1}{2}$  m. Then, find the area.



- f. Draw a model for a rectangle measuring  $2\frac{1}{2}$  meters by  $10\frac{3}{4}$  m. Then, find the area.



- g. Draw a model for a rectangle measuring  $9\frac{1}{2}$  units by  $2\frac{1}{3}$  units. Then, find the area.



9. Draw and find the area of a model measuring by the following dimensions.

a.  $\frac{1}{3}$  unit  $\times$   $\frac{1}{4}$  unit

b.  $\frac{2}{3}$  unit  $\times$   $\frac{1}{2}$  unit

c.  $\frac{4}{5}$  centimeters  $\times$   $\frac{3}{8}$  cm

d.  $\frac{5}{6}$  m  $\times$   $\frac{1}{3}$  m

e.  $\frac{2}{9}$  meters  $\times$   $\frac{1}{5}$  m

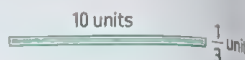
f.  $\frac{3}{4}$  kilometers  $\times$   $\frac{2}{3}$  km

g.  $\frac{3}{5}$  m  $\times$   $\frac{3}{4}$  m

h.  $\frac{2}{7}$  unit  $\times$   $\frac{7}{9}$  unit

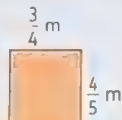
### 10. Multiplying to find area.

- a. Akram's herb garden is 10 units long by  $\frac{1}{3}$  unit wide. What is the area of Akram's herb garden?

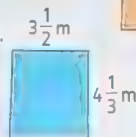


- b. A trench was dug in Doaa's backyard to fix her plumbing. The ditch was 8 meters long and  $\frac{1}{10}$  m wide. What is the area of the ditch?

- c. What is the area of the rectangle shown?



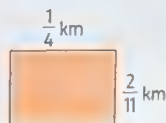
- d. Mostafa draw the opposite rectangle. Calculate the area of Mostafa's rectangle.



- e. Omar owns a parking lot. The lot is 3 kilometers long and  $2\frac{1}{2}$  km wide. What is the area of the parking lot?

- f. A mosque has a window that is  $\frac{3}{10}$  meter wide and 2 m long. What is the area of the window in square meters?

- g. The university is building a new courtyard. The outline of the courtyard is shown. Find its area.

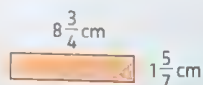
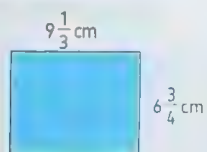


- h. Which is greater in area?

A rectangle of length  $3\frac{1}{2}$  m and width  $5\frac{1}{3}$  m

or a rectangle of length  $4\frac{2}{3}$  m and width  $4\frac{1}{2}$  m

- i. What is the sum of areas of the following two rectangles?



## Multiple Choice Questions

Choose the correct answer.

1. The area of the opposite rectangle = \_\_\_\_\_ square units.



- A. 15 B. 18 C. 20 D. 24

2. The area of rectangle of length  $\frac{2}{3}$  cm and width  $\frac{1}{4}$  cm is \_\_\_\_\_ cm<sup>2</sup>

- A.  $\frac{11}{12}$  B.  $\frac{1}{6}$  C.  $\frac{5}{12}$  D.  $\frac{3}{8}$

3. The area of rectangle of dimensions  $7\frac{1}{2}$  meters and  $2\frac{1}{5}$  meters is \_\_\_\_\_ m<sup>2</sup>

- A.  $5\frac{3}{10}$  B.  $14\frac{3}{10}$  C.  $9\frac{7}{10}$  D.  $16\frac{1}{2}$

4. The area of rectangle of dimensions  $\frac{2}{5}$  m and  $\frac{1}{3}$  m



The area of rectangle of length  $\frac{3}{8}$  m and width  $\frac{1}{5}$  m

- A. > B. < C. =

5. The area of room of length 6 m and width  $3\frac{1}{2}$  m is \_\_\_\_\_ m<sup>2</sup>

- A. 19 B.  $9\frac{1}{2}$  C. 21 D. 42

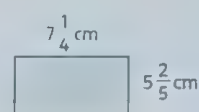
6. Area of rectangle =

- A. L + W B. L  $\times$  W C.  $\frac{L}{W}$  D. (L + W)  $\times$  2

7. The area of rectangle of dimensions  $3\frac{1}{5}$  cm and  $2\frac{1}{2}$  cm is \_\_\_\_\_

- A. 8 m<sup>2</sup> B. 8 cm<sup>2</sup> C. 8 km<sup>2</sup> D. 8 cm

8. Area of opposite rectangle = \_\_\_\_\_ cm<sup>2</sup>



- A.  $25\frac{3}{10}$  B.  $40\frac{1}{2}$  C.  $12\frac{13}{20}$  D.  $39\frac{3}{20}$

9. The area of rectangle with length  $\frac{3}{4}$  km and width  $\frac{1}{3}$  km is \_\_\_\_\_

- A.  $\frac{1}{4}$  km B.  $\frac{1}{4}$  km<sup>2</sup> C.  $\frac{13}{12}$  km D.  $\frac{1}{2}$  km<sup>2</sup>

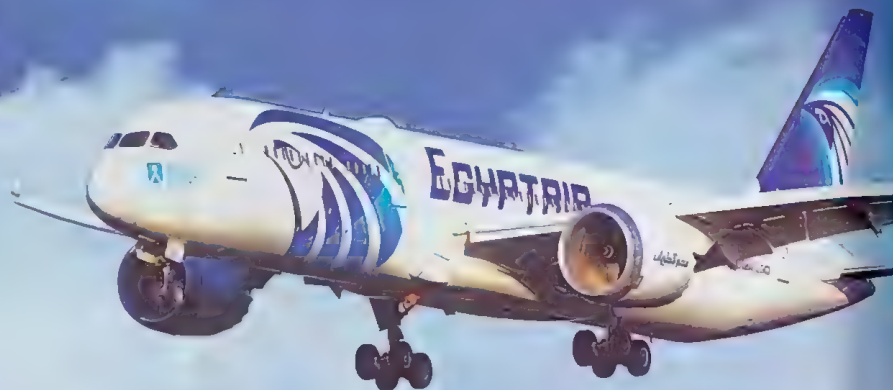
10. A mosque has a window that is  $\frac{3}{5}$  meter wide and  $1\frac{1}{2}$  meters long. What is the area of the window in square meters?

- A.  $\frac{9}{10}$  m<sup>2</sup> B.  $2\frac{1}{2}$  m<sup>2</sup> C.  $2\frac{1}{10}$  m<sup>2</sup> D.  $10\frac{1}{2}$  m<sup>2</sup>

## Concept

# 2

## Coordinate Planes



### Did You Know?!

Air traffic is managed and regulated by using coordinate geometry. Coordinates of the flight are used to describe its current location of the aircraft.

Lesson No.	Lesson Name	Learning Objectives
Lessons 6 to 8	Introduction to Coordinate Planes Plotting Points on a Coordinate Plane Coordinate Designs	<ul style="list-style-type: none"> <li>Students will describe a coordinate plane.</li> <li>Students will define elements of a coordinate plane.</li> <li>Students will identify points on a coordinate plane.</li> <li>Students will name points on a coordinate plane.</li> <li>Students will plot ordered pairs on a coordinate plane to create a picture.</li> </ul>
Lesson 9	From Patterns to Points	<ul style="list-style-type: none"> <li>Students will identify and extend numerical patterns.</li> <li>Students will graph points from a numerical pattern.</li> </ul>
Lessons 10 & 11	Graphing Real-World Data Interpreting Real-World Graphs	<ul style="list-style-type: none"> <li>Students will interpret data on coordinate planes.</li> <li>Students will solve real-world problems involving data on coordinate planes.</li> <li>Students will interpret data on coordinate planes.</li> <li>Students will solve real-world problems involving data on coordinate planes.</li> </ul>

## Lessons 6 to 8

- Introduction to Coordinate Planes
- Plotting Points on a Coordinate Plane
- Coordinate Designs

### Learn 1 The distance between two points on a ray

The distance between the two points A and B on a horizontal ray or a vertical ray =  $\overline{AB}$  where :

The length of  $\overline{AB}$  = number of the ending point – number of the starting point =  $B - A$

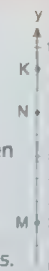
For Example :

[1] In the following figure :



If A represents the number 3 ,  
 B represents the number 7 and  
 C represents the number 10 , then  
 $AB = B - A = 7 - 3 = 4$  units.  
 $BC = C - B = 10 - 7 = 3$  units.  
 and  $AC = C - A = 10 - 3 = 7$  units.

[2] In the following figure :

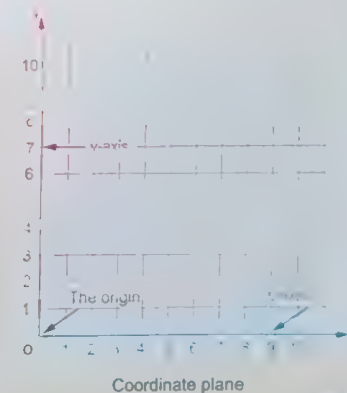


If M represents the number 2 ,  
 N represents the number 7 and  
 K represents the number 9 , then  
 $MN = N - M = 7 - 2 = 5$  units.  
 $NK = K - N = 9 - 7 = 2$  units.  
 and  $MK = K - M = 9 - 2 = 7$  units.

### Learn 2 Locating points on a coordinate plane

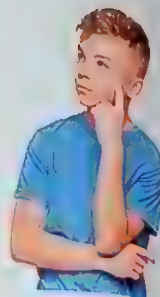
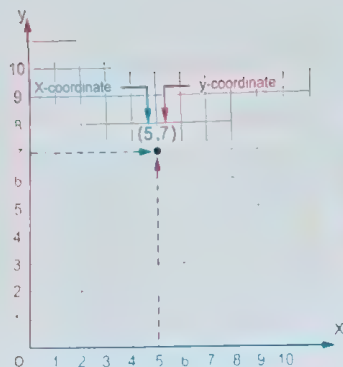
#### • The coordinate plane

The coordinate plane is the plane determined by a horizontal line , called the **x-axis** , and a vertical line , called the **y-axis** , intersecting at a point , called the **origin**. It is labeled as "O"



## The ordered pair

The ordered pair is a pair of numbers used to locate any point on a coordinate plane. Ordered pairs are written left to right  $(x, y)$



For Example :

The ordered pair  $(5, 7)$

### X-coordinate

The first number in an ordered pair, which tells how far to move left or right from the origin. It is labeled as "X"



### Y-coordinate

The second number in an ordered pair, which tells how far to move up or down from the origin. It is labeled as "Y"



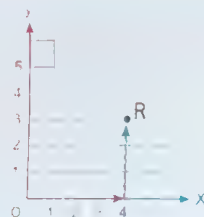
### Note that

The coordinates for the origin are  $(0, 0)$



## How can you graph a point on a coordinate plane?

### Example A



Graph the point  $R(4, 3)$

#### Step 1

Start at the origin.

#### Step 2

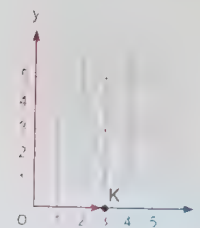
Move right 4 units.

#### Step 3

Move up 3 units. Draw a point. Label it R.

### Example B

Graph the point  $K(3, 0)$



#### Step 1

Start at the origin.

#### Step 2

Move right 3 units.

#### Step 3

Move up or down 0 units. Draw a point. Label it K.

## Example 1

Using the following graph, answer [a], [b] and [c]

a. What is the name of each of the following points?

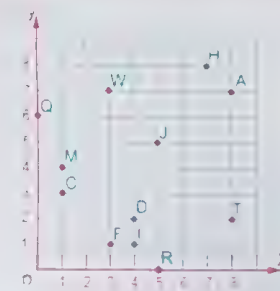
- $(3, 1)$
- $(7, 8)$
- $(1, 4)$
- $(5, 0)$
- $(8, 7)$
- $(4, 2)$
- $(5, 5)$
- $(1, 3)$

b. Write the ordered pair for each of the following points :

- A
- T
- W
- I
- Q

c. Plot the following points on the coordinates grid :

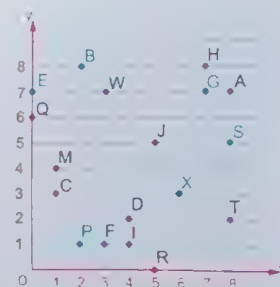
- $B(2, 8)$
- $E(0, 7)$
- $X(6, 3)$
- $S(8, 5)$
- $P(2, 1)$
- $G(7, 7)$



### Solution

- F
- H
- M
- R
- A
- D
- J
- C
- $(8, 7)$
- $(8, 2)$
- $(3, 7)$
- $(4, 1)$
- $(0, 6)$

c. The points are represented on the coordinates grid.



## Example 2

Graph the points A(1,6), B(1,2), C(7,2), D(7,6)

Connect them in order: A → B → C → D → A

- What is the name of the figure ABCD?
- What attributes did you use to identify it?
- What line segments in this figure are parallel?
- What line segments are perpendicular?
- What is the distance between A and D?

### Solution

- ABCD is a rectangle.
- Two sets of parallel sides, four right angles, two sets of two equal sides.
- $\overline{AD} \parallel \overline{BC}$ ,  $\overline{DC} \parallel \overline{AB}$

#### Remark

The symbol  $\parallel$  as a way to show that two lines are parallel.

- $\overline{AB} \perp \overline{BC}$ ,  $\overline{BC} \perp \overline{DC}$ ,  $\overline{DC} \perp \overline{AD}$ ,  $\overline{AB} \perp \overline{AD}$

#### Remark

The symbol  $\perp$  as a way to show that two lines are perpendicular.

- The distance between A and D is 6 units.

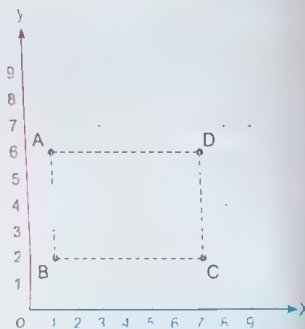
### Check your understanding

Plot the points on the coordinate grid.

A(3,5), B(6,5), C(6,2), D(3,2) and connect the points in order.

- What polygon did you create?
- Complete.

- $\overline{AD} \parallel$
- $\overline{AB} \parallel$
- $\overline{DC} \perp$
- $\overline{BC} \perp$



## Exercise 18

on lessons 6 to 8

REMEMBER

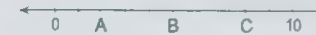
UNDERSTAND

APPLY

PROBLEM SOLVING

From the school book

- Use the number line to answer the questions.



- What is the value of B?
- What is the value of A?
- What is the value of C?
- Write a D above the point with a value of 7.

- Use the number line to answer the questions.



- What is the value of C?
- What is the value of D?
- What is the value of A?
- How far is point B from D?
- How far is point C from A?

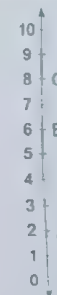
- Use the number line to answer the questions.



- What is the value of each space between the hashmarks?
- What is the value of A?
- What is the value of B?
- What is the value of C?
- What is the value of D?

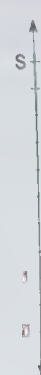
- Use the number line to answer the questions.

- What is the value of A?
- What is the value of B?
- What is the value of C?
- How far is point C from point A?
- How far is point B from point A?

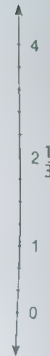


5. What is the value of each space between the hashmarks ?

a.



b.



c.



d.



6. In the following grid, observe and answer.

a. What is the name of each of the following points ?

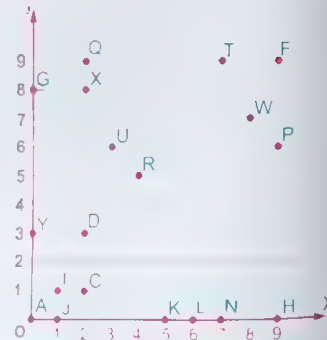
1. (0, 8)
2. (9, 6)
3. (6, 0)
4. (2, 3)
5. (1, 0)
6. (7, 9)
7. (4, 5)
8. (2, 9)
9. (9, 0)
10. (0, 0)

b. Write the ordered pair of each of the following points :

1. W
2. Y
3. N
4. F
5. C
6. X
7. K
8. U
9. I

c. Plot the following points on the coordinates grid :

1. E (7, 5)
2. M (1, 5)
3. Z (8, 2)
4. B (9, 3)
5. V (8, 9)
6. S (5, 8)



7. In the opposite figure :

a. Complete :

1. Point C ( , ) and point D ( , )
2. AC = units and CD = units.

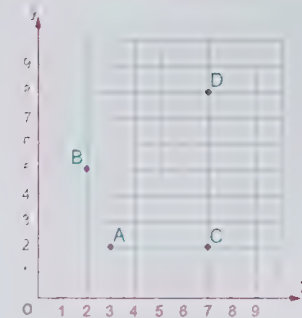
b. On the figure, plot the points

M (5, 2) and N (5, 8), then complete :

CM = units, MN = units,  
ND = units

The name of the figure MNDC is and

The perimeter of the figure MNDC is units.

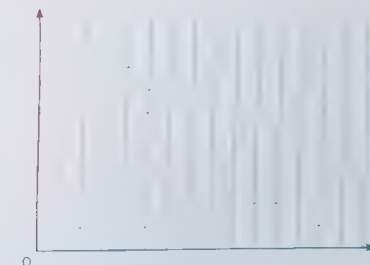


8. a. Plot the points on the coordinate grid.

- A (3, 2)
- B (3, 5)
- C (6, 5)
- D (6, 2)

b. Connect the points in order.

What polygon did you create ?



9. In the opposite coordinate plane :

a. Graph the figure ABCD where

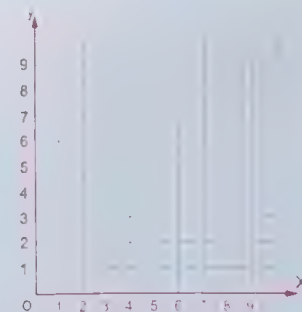
- A (2, 8), B (3, 4),
- C (8, 4) and D (7, 8)

b. What is the name of the figure

ABCD ?

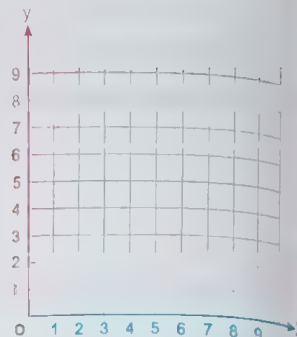
c. What is the length of  $\overline{AD}$  ?

d.  $\overline{AD} \parallel$  ,  $\overline{AB} \parallel$



10. In the opposite coordinate plane :

- Graph the figure ABCD where  $A(0,3)$ ,  $B(7,3)$ ,  $C(7,5)$ ,  $D(0,5)$ .
- What is the name of the figure ABCD?
- What attributes did you use to identify it?
- What line segments in this figure are parallel?
- What line segments are perpendicular?



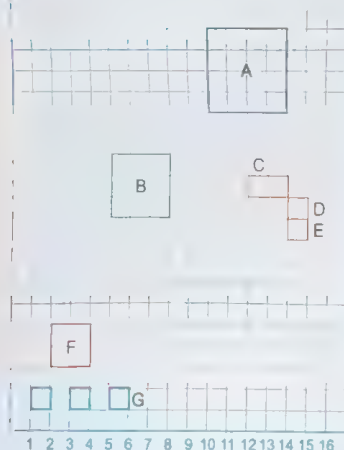
11. Answer the following questions.

- What do we call the point  $(0,0)$ ?
- What is the x-coordinate of the origin point?
- What is the y-coordinate of the origin point?
- Is the point  $(3,5)$  the same as  $(5,3)$ ?

12. Visiting the Pyramids of Giza.

Use this graph as you complete the related tasks.  
Move the given vocabulary words to where they belong on the graph.  
Then use what you know about plotting points to complete the remaining tasks.

x-axis origin y-axis

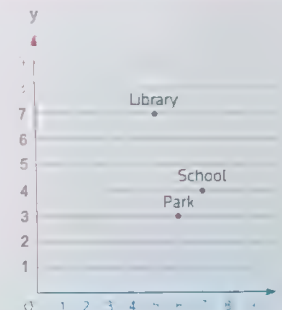


- Pyramid of Khufu
- Pyramid of Khafre
- Sphinx
- Sphinx Temple
- Valley Temple
- Pyramid of Menkaure
- Pyramids of Queens (3)

- Use the vocabulary words to label the coordinate plane.  
x-axis y-axis origin

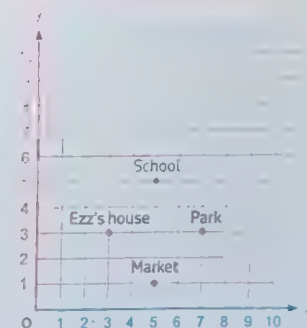
- Start at the origin. Move horizontally on the x-axis 4 units to the right and vertically on the y-axis 5 units up. What structure is located here?
- From the origin, move 13 units horizontally on the x-axis and 17 units vertically on the y-axis. What structure is located here?
- From the last point, move left on the x-axis 5 units and then down the y-axis 5 units. What structure is located here?
- If we move 6 units to the right on the x-axis and zero units on the y-axis from the last point, what structure is located here?
- Describe how to move from the Sphinx to the Valley Temple.
- Locate the Sphinx and the Pyramids of the Queens.
- Starting at the Sphinx, write directions to Pyramids of the Queens. Use directional words such as horizontally / left / right and vertically / up / down. Describe how to move using the vocabulary terms x-axis and y-axis. Remember to begin with directions along the x-axis.
- Exchange your work with a partner and see if, using your directions, your partner can move from the Sphinx to the Pyramids of the Queens.

- Using the coordinate grid, name the ordered pair that represents the library.
  - Using the coordinate grid, name the ordered pair that represents the park.
  - Using the coordinate grid, name the ordered pair that represents the school.
  - Fill in the blanks : To move from the school to the library, travel to the left of the x-coordinate — units. Then, travel up from the y-coordinate — units.

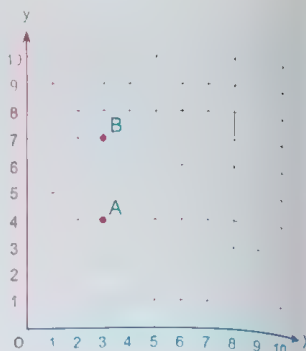


14. The figure shown represents a city designed with the grid plan.

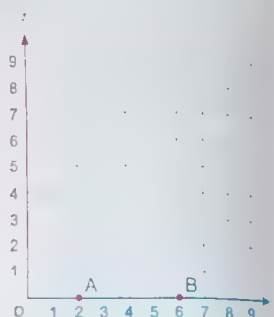
- A "bird's-eye view" refers to looking down from above. If a bird was to fly directly from Ezz's house to the school, then to the park, and back to Ezz's house, what polygon would its flight path represent?
- If the bird was instead, fly from the park to the market before going back to Ezz's house, what polygon would its path represent?



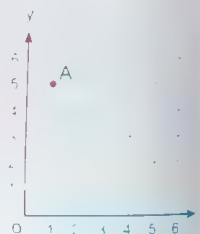
15. a. Record the ordered pairs for point A and B on the coordinate plane.
- b. Draw a line connecting the two points.
- c. Place a coordinate point C to create an isosceles right triangle with the right angle at point A. Record the ordered pair on the coordinate plane.



16. a. Record the ordered pairs for points A and B on the coordinate plane.
- b. Draw a line connecting the two points.
- c. Place a coordinate point C and D to create a square ABCD.
- Record the ordered pair on the coordinate plane.

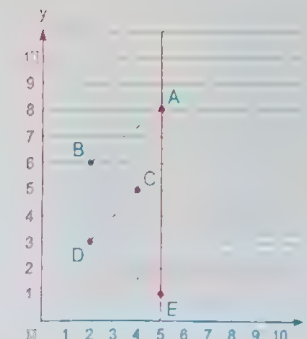


17. On the coordinate plane, plot and label the given ordered pairs A through J. Then, connect the dots to create a picture. Connect point J to point A to close the shape.
- Point A is done for you.



- |           |           |           |           |           |
|-----------|-----------|-----------|-----------|-----------|
| A. (1, 5) | C. (5, 1) | E. (4, 2) | G. (3, 3) | I. (2, 4) |
| B. (1, 1) | D. (5, 2) | F. (4, 3) | H. (3, 4) | J. (2, 5) |

18. On the coordinate plane, plot points F, G, and H to make a figure that is symmetrical along the vertical orange line drawn on the coordinate plane. (Point F should follow point E) Connect point H to point A to close the shape. Then, list the coordinates of F, G and H.



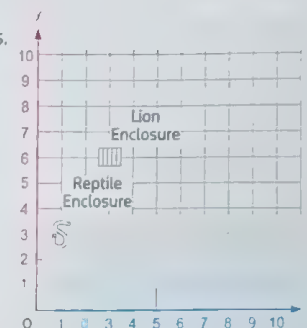
19. Look at the zoo map. The lion and the reptile houses have already been located. Place the Zebra Enclosure and the Snack Shop on the map according to the rules listed.

Rules :

- Zebras must be at least 3 units away from the lions.
- The Snack Shop cannot be closer than 6 units to the reptiles.
- The four structures must create a parallelogram on the zoo map.

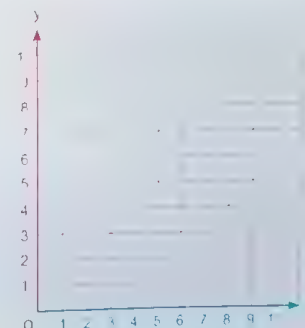
Which two points will fit the given criteria ?

- Zebra Enclosure (4, 5); Snack Shop (3, 3)
- Zebra Enclosure (9, 6); Snack Shop (7, 3)
- Zebra Enclosure (6, 6); Snack Shop (4, 3)
- Zebra Enclosure (6, 6); Snack Shop (3, 4)



### Challenge

20. Choose one of the objects to graph on the coordinate plane by plotting points and connecting these points. List each of the points for your object as a set of ordered pairs.



Objects :

- A star.
- A hexagon.
- A house.
- A pentagon.

Choose the correct answer.

1. The point (0, 3) lies on  
A. x-axis B. y-axis C. origin point

3. The ordered pairs which represents  $\triangle ABC$  are \_\_\_\_\_  
A. (4, 2), (4, 5), (2, 5)  
B. (2, 4), (4, 4), (4, 2)  
C. (2, 4), (4, 1), (4, 2)  
D. (4, 4), (4, 2), (1, 4)

5. The ordered pair which represents an isosceles right-angled triangle at point B is  
A. (1, 4) B. (3, 4)  
C. (4, 3) D. (4, 4)

7. Which of the following points located on x-axis?  
A. (3, 0) B. (0, 5)  
C. (3, 7) D. (10, 2)

8. Without graphing which of the following ordered pairs if connected would form a square?  
A. (1, 3), (1, 1), (5, 1), (5, 3) B. (0, 0), (0, 3), (3, 0), (3, 3)  
C. (1, 5), (2, 5), (1, 1), (2, 1) D. (0, 0), (0, 2), (2, 0), (2, 3)

2. The point (5, 0) lies on  
A. x-axis B. y-axis C. origin point

4. The ordered pairs which represents the rectangle ABCO are  
A. (0, 0), (3, 0), (2, 0), (2, 3)  
B. (0, 0), (0, 2), (2, 3), (3, 0)  
C. (0, 0), (0, 3), (2, 0), (2, 3)  
D. (0, 0), (3, 0), (2, 4), (2, 0)

6. a. How far is point C from point D?  
A. 2 B. 3  
C. 4 D. 5  
b.  $\overline{AB} \parallel$   
A.  $\overline{AD}$  B.  $\overline{BC}$   
C.  $\overline{DC}$  D.  $\overline{AC}$   
c.  $\overline{DC} \perp$   
A.  $\overline{AC}$  B.  $\overline{BC}$   
C.  $\overline{BD}$  D.  $\overline{AB}$



## From Patterns to Points

### Learn 1

Ordered pairs can be represented on a coordinate plane and tables which show x values and y values.

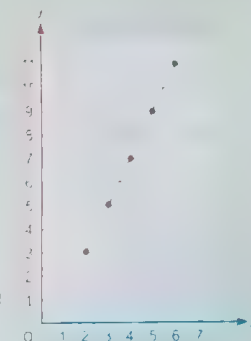
For Example: (2, 3), (3, 5), (4, 7), (5, 9)

### Notice that

- The x values are: 2, 3, 4, 5, ....  
The values are in a pattern and increase by 1. So, the expected next value is 6
- The y values are: 3, 5, 7, 9, ....  
The values are in a pattern and increase by 2. So, the expected next value is 11
- The plotted points on a coordinate plane create a line which is called a **line graph**.
- Mathematicians often use **tables** to create ordered pairs that they can graph to look for patterns.

x values	2	3	4	5
y values	3	5	7	9

(2, 3) (3, 5) (4, 7) (5, 9) (6, 11)



### Example 1

Use the ordered pairs to fill in the table.

(1, 2) , (2, 3) , (3, 4) , (4, 5) , (5, 6)

### Solution

x values	1	2	3	4	5
y values	2	3	4	5	6



## Example 2

Extend the following table and identify the pattern.

x values	0	2	4	6	—	—	—
y values	1	4	7	10			

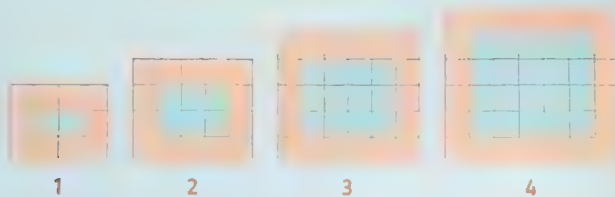
## Solution

x values	0	2	4	6	8	10	12
y values	1	4	7	10	13	16	19

- The x values are : 0, 2, 4, 6, 8, 10, 12 in a pattern and increase by 2
- The y values are : 1, 4, 7, 10, 13, 16, 19 in a pattern and increase by 3

## Learn 2

Kamal is a designer. He is building a collection of pool in a garden. In Kamal's design, the pools increase in size. The sketches of his ideas are shown. The orange tiles represent the outer line around the pool. The green tiles represent the inner units.



The table for orange tiles in designs 1 to 4 can be represented as :

Pool design, x	1	2	3	4	5	6
Number of orange tiles, y	10	14	18	22	26	...

(22 + 4) (26 + 4)

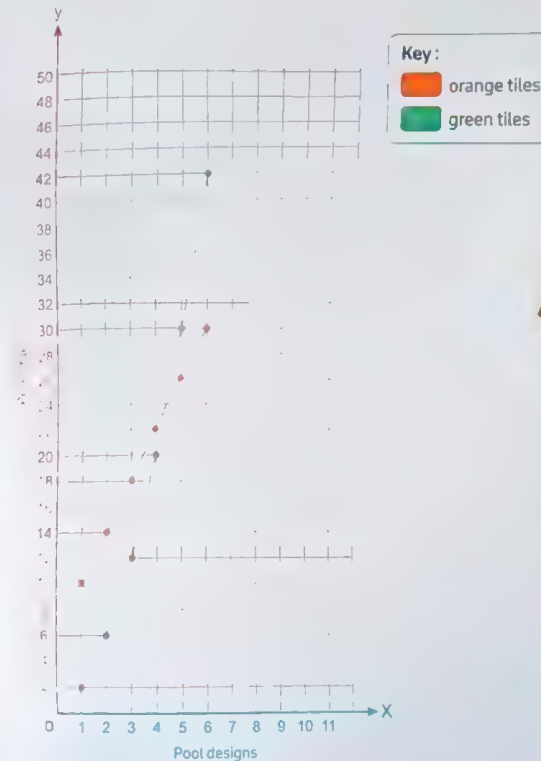
The prediction of the design<sup>n</sup>

The table for green tiles in designs 1 to 4 can be represented as :

Pool design, x	1	2	3	4	5	6
Number of green tiles, y	2	6	12	20		

(5 × 6) (6 × 7)

The two tables can be represented in one graph by two keys with two colors, each line and color show a table as follows :



## Example 3

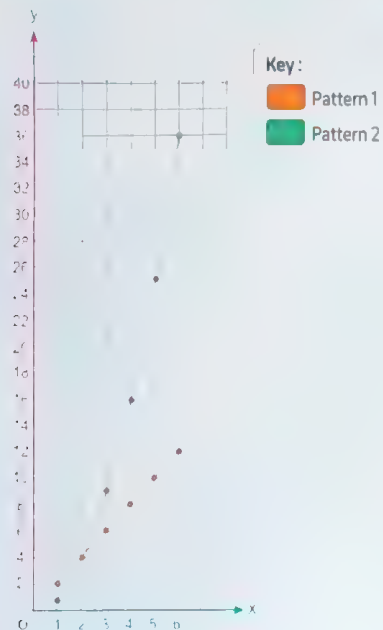
Represent the two tables on one graph with two keys.

Design, x	1	2	3	4	5	6
Pattern 1, y	2	4	6	8	10	12

Design, x	1	2	3	4	5	6
Pattern 2, y	1	4	9	16	25	36

## Solution



The y values in pattern 1 increase by 2

The y values in pattern 2 increase by multiplying each number by itself as  $(1 \times 1)$ ,  $(2 \times 2)$ ,  $(3 \times 3)$ ,

## Exercise 19

on lesson 9

REMEMBER UNDERSTAND APPLY PROBLEM SOLVING

From the school book

1. Use the ordered pairs to fill in the table.

a.  $(0, 1)$ ,  $(2, 3)$ ,  $(4, 5)$ ,  $(6, 7)$  and  $(8, 9)$

x values					
y values					

b.  $(1, 1)$ ,  $(2, 2)$ ,  $(3, 3)$ ,  $(4, 4)$  and  $(5, 5)$

x values					
y values					

c.  $(2, 4)$ ,  $(3, 6)$ ,  $(4, 8)$ ,  $(5, 10)$ ,  $(6, 12)$  and  $(7, 14)$

x values	2				
y values	4				

2. Extend the following table and identify the pattern of x values and y values.

a.

x values	1	2	3	4			
y values	1	2	3	4			

b.

x values	10	20	30	40		
y values	1	5	9	13		

c.

x values	$\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$		
y values	$1\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$		

d.

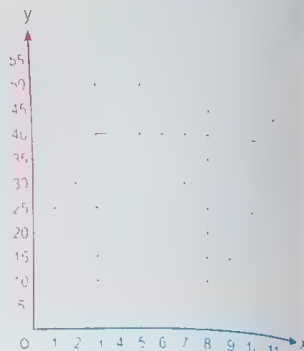
x values	2	4	6	8		
y values	36	33	30	27		



3. Represent the following tables on the coordinate plane.

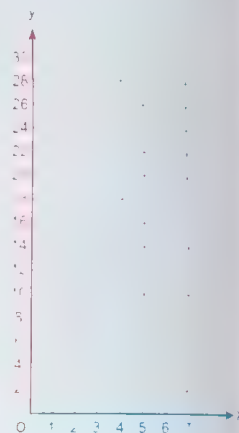
a.

x values	1	3	5	7	9	11
y values	5	15	25	—	—	—



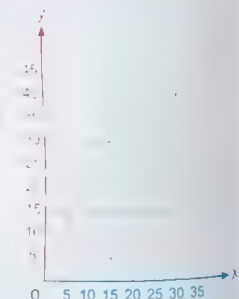
b.

x values	1	2	3	4	5	6	7
y values	3	6	9	—	—	—	—



c.

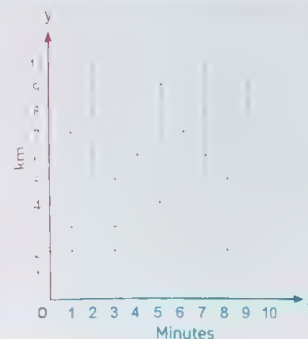
x values	0	5	10	15	20	25	30	35
y values	45	40	35	—	—	—	—	—



4. Hesham is driving his car, the table shows the distance travelled in 8 minutes when his speed is 60 km per hour. Fill in the missing y values based on the pattern.

Minutes x values	1	2	3	4	5	6	7	8
Travelled km y values	1	2	3	—	—	—	—	—

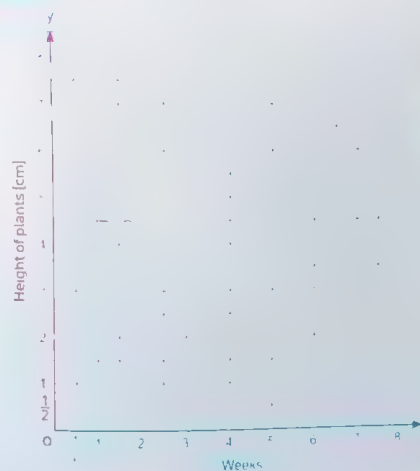
Graph the coordinate points from the table.



5. Challenge 1. Look at the table and fill in the missing y values based on the pattern of plant height in Haitham's garden from one week to the next.

Weeks, x	1	2	3	4	5	6
Height of plants, y	$\frac{1}{2}$ cm	2 cm	$3\frac{1}{2}$ cm	—	—	—

Challenge 2. Graph the coordinate points from the Challenge 1 table.

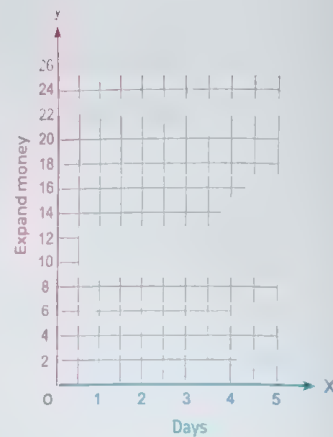


6. The following tables show the expanded money for 5 days of Wael and Sara.

Represent the two tables on the coordinate grid with two line graphs.

Days, x	1	2	3	4	5
Expand of Wael, y	4	11	15	18	20

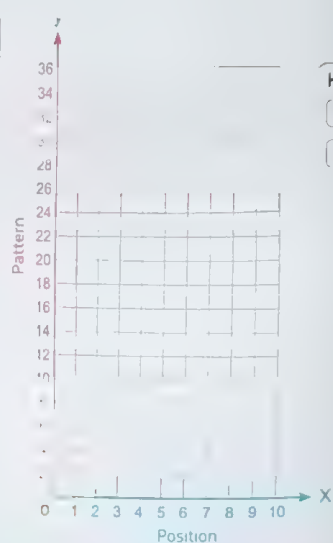
Days, x	1	2	3	4	5
Expand of Sara, y	2	10	15	20	25



7. Explore the pattern of each table. Complete the missing values of y, then graph the tables of the coordinate plane. Finally describe the two patterns if increase and decrease.

Position	1	2	3	4	5	6	7
Pattern 1	5	8	11				

Position	1	2	3	4	5	6	7
Pattern 2	30	27	24				



8. Haitham is a city planner. He is building a collection of square garden beds in a local park. In Haitham's design, the gardens increase in size as you move through the park. Shown are the sketches of his ideas. The yellow squares represent the square tile border around the outside of the garden. The white tiles represent square units of dirt.

- a. Fill in the table for the yellow tiles in designs 1 to 4. Then, record your predictions for designs 5 and 6.

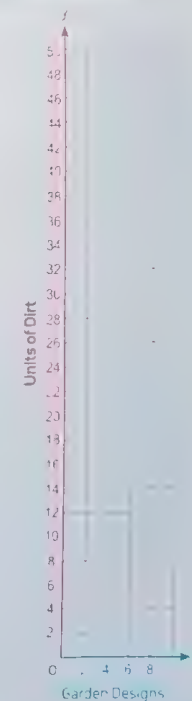
Garden Design, x	1	2	3	4	5	6
Number of Yellow Units, y						

Key:	
	Square Units around the Garden
	Dirt

- b. Fill in the table below for the white tiles in designs 1 to 4. Then, record your predictions for designs 5 and 6.

Garden Design, x	1	2	3	4	5	6
Number of White Units, y						

- c. Use the information from the tables you completed to plot the coordinates for designs and number of tiles. Use one color to connect the first set of points and color in the Square Units around the Garden Key with that color. Use a different color to connect the second set of points and color in the Dirt Key with that color. Your finished coordinate grid will have two line graphs.



## 9. Transportation plays a vital role in city planning.

Major cities around the world rely on buses, trolleys, trains, metros, and taxis to move people around. Public transportation usually runs on a set timetable so people can plan their travels based on arrivals and departures.

As population increases in different areas, governments respond by creating additional transportation options. In Cairo, some buses are run by the Cairo Transport Authority, while others are smaller minibuses run by private companies.



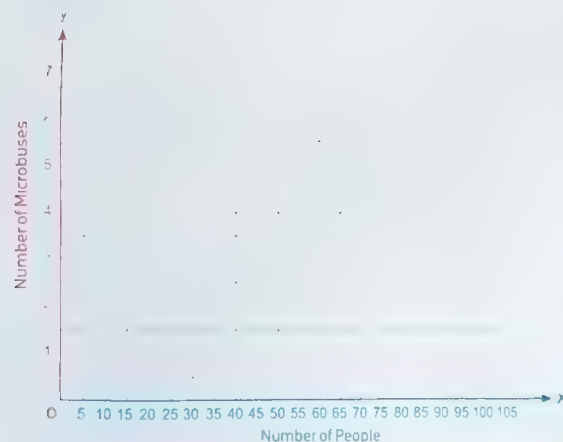
Minibus

- a. Kamal runs a transportation company and considers adding to his fleet of minibuses.

Each bus can hold 15 passengers. Extend the pattern to complete the table.

Total Number of Passengers, x	A	30	C	60	E	90	G
Number of Microbuses, y	1	B	3	D	5	F	7

- b. Graph the microbus data on the coordinate plane.



## Multiple Choice Questions

Choose the correct answer.

1. The points  $(2, 4)$ ,  $(3, 6)$  and  $(4, 8)$  can be represented in a table as .

A. 

x	2	6	4
y	4	3	8

B. 

x	2	3	4
y	4	8	6

C. 

x	2	3	4
y	4	6	8

D. 

x	4	6	8
y	2	3	4

2. The values of the missing numbers in the table are

x values	1	2	3	4	5
y values	3	6	9		

A. 12, 14

B. 12, 15

C. 11, 15

D. 15, 18

3. The description of the patterns in the following table is

x values	2	3	4	5	6	7
y values	1	3	5	7	9	11

A. x values increase by 1 and y values increase by 1

B. x values decrease by 1 and y values increase by 2

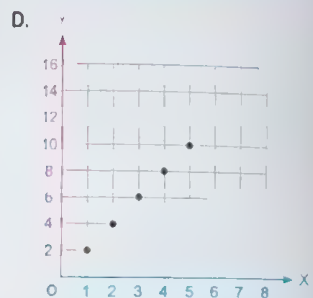
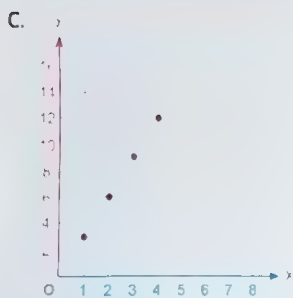
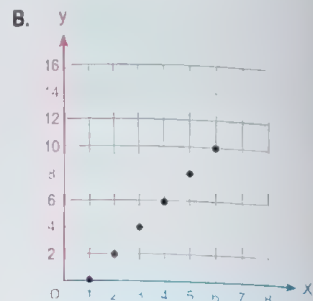
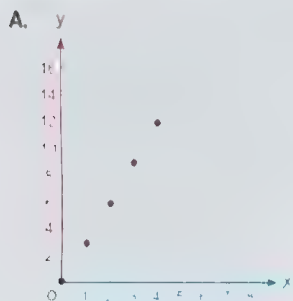
C. x values increase by 1 and y values increase by 2

D. x values increase by 2 and y values decrease by 2



4. The following table can be represented on the coordinate

x values	0	1	2	3	4
y values	0	3	6	9	12

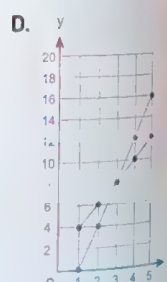
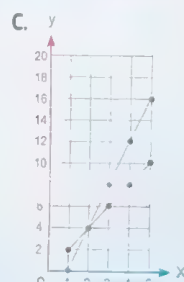
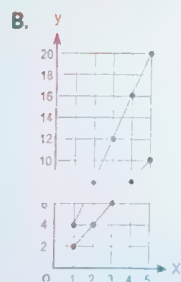
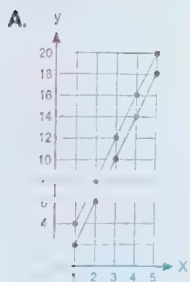


5. The following tables can be represented on the coordinates plane as:

x	1	2	3	4	5
Pattern 1	2	4	6	8	10
x	1	2	3	4	5
Pattern 2	0	4	8	12	16

Key: Pattern 1

Pattern 2



- Graphing Real-World Data
- Interpreting Real-World Graphs

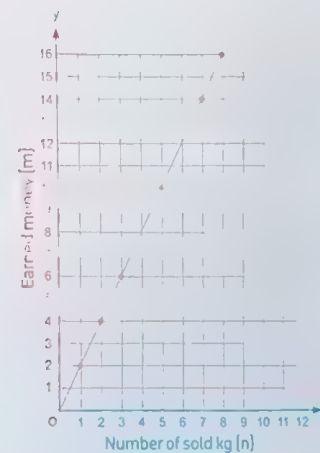
### Learn 1 Graphing real-world data

A fruiter earns 2 L.E. for each sold kg of oranges, the relation between the number of sold kg ( $n$ ) and the earned money ( $m$ ) can be represented by the rule  $m = 2 \times n$

, the following table shows that:

Number of sold kg [ $n$ ]	1	2	3	5	7	8
Earned money [ $m$ ] in L.E.	2	4	6	10	14	16

Using the data of the number of sold kg as X-coordinates and the data of the earned money as Y-coordinates, plot data on the coordinate grid, then draw a line to connect the points.



From the previous, we can answer questions like

1. How much money does the fruiter earn when the sold oranges is 4 kg?
2. How many kg of oranges the fruiter needs to sell to earn 12 L.E.?

By many methods :

### 1<sup>st</sup> method : Using the pattern

Sold kg	1	2	3	4	5	6	7	8
Earned money	2	4	6	8	10	12	14	16

By using the pattern, we can deduce that :

- The fruiter will earn 8 L.E. if he sells 4 kg of oranges.
- The fruiter needs to sell 6 kg of oranges to earn 12 L.E.

### 2<sup>nd</sup> method : From the graph



The fruiter will earn 8 L.E. if he sells 4 kg of oranges



The fruiter needs to sell 6 kg of oranges to earn 12 L.E.

### 3<sup>rd</sup> method : Using the rule

$$m = 2 \times n$$

- At the sold number of kg  $[n] = 4$  kg, then the earned money  $[m] = 2 \times 4 = 8$  L.E.
- To make the fruiter earned money  $[m] = 12$ , then  $12 = 2 \times n \Rightarrow n = 6$  kg  
i.e. the fruiter needs to sell 6 kg to earn 12 L.E.

### Check your understanding

High-speed train covers 4 km each minute, deduce the relation between the covered distance  $[S]$  km and the elapsed time  $[t]$  minute, then answer the following :

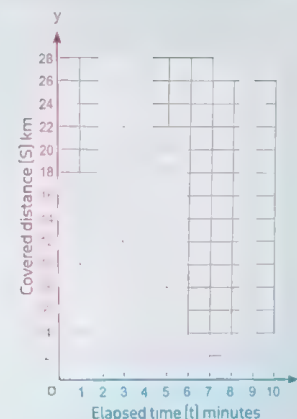
1. What is the rule that represents the relation between  $[S]$  and  $[t]$  ?

2. Complete the table :

Elapsed time $[t]$ in minutes	1	2	3	—	5	—
Covered distance $[S]$ in km	4	8	12	—	—	24

3. From the previous table :

Use the data of the elapsed time as x-coordinates and the covered distance data as y-coordinates, plot the data on the coordinate grid, draw a line to connect the points.



4. What is the covered distance if the elapsed time is 3 minutes ?

5. What is the elapsed time to cover a distance 28 km ?

6. What is the covered distance if the elapsed time is 8.5 minutes ?

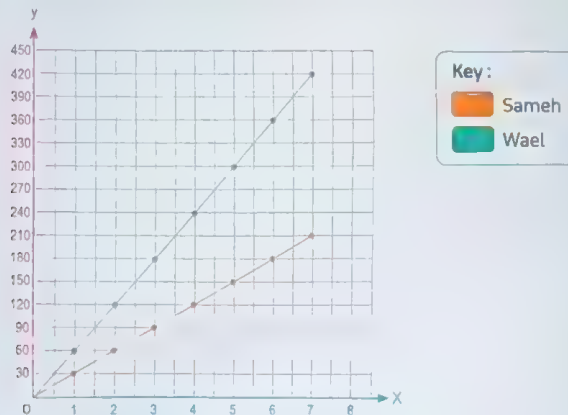
## Learn 2 Graphing data of two related tables on the same coordinates plane

For a week, Sameh saves 30 L.E. per day and Wael saves 60 L.E. per day, then you can fill the following two tables.

Sameh (30 L.E. per day)		Wael (60 L.E. per day)	
Number of days	Total saved money (L.E.)	Number of days	Total saved money (L.E.)
1	30	1	60
2	60	2	120
3	90	3	180
4	120	4	240
5	150	5	300
6	180	6	360
7	210	7	420



- To graph the data of the two tables on the same coordinates plane, you use a different color to represent each person data as the following.



From the graph, you can answer some questions like :

- At the end of the week, who saved farther ?  
➔ Wael saved farther than Sameh.
- How much farther did he save ?  
➔ Since,  $420 - 210 = 210$ , then Wael saved 210 L.E. farther than Sameh.
- After how many days did Sameh and Wael save 120 L.E. ?  
➔ Sameh saved 120 L.E. after 4 days and Wael saved 120 L.E. after 2 days.

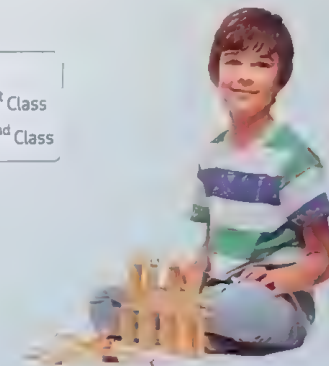
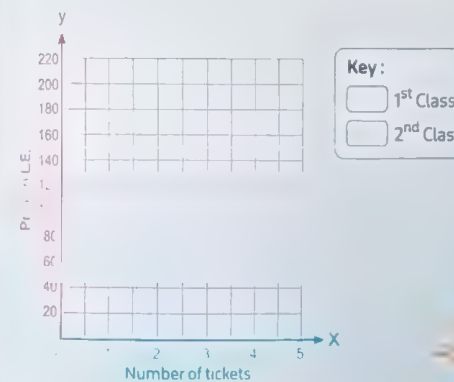
## Check your understanding

The seats of children's theatre is divided into two sections, 1<sup>st</sup> class and 2<sup>nd</sup> class. The price of the ticket of 1<sup>st</sup> class is 40 L.E. and of 2<sup>nd</sup> class is 20 L.E.

- Use these data to fill the following tables.

1 <sup>st</sup> Class (40 L.E.)		2 <sup>nd</sup> Class (20 L.E.)	
Number of tickets	Price in (L.E.)	Number of tickets	Price in (L.E.)
1	40	1	
2		2	
3		3	
4		4	
5		5	

- Graph these data on the same coordinates plane using a different color to represent each class data and represent the number of tickets on x-coordinate and the price on y-coordinate.

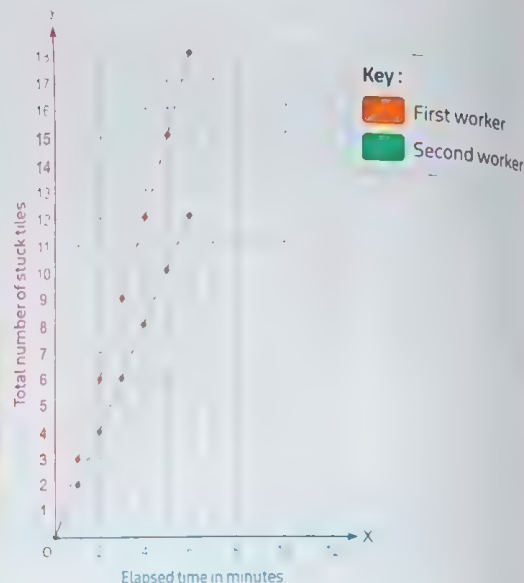


- From the graph, how many tickets of 1<sup>st</sup> class or 2<sup>nd</sup> class can be sold for 80 L.E. ?

### Learn 3 Interpreting real-world graphs

#### Example 1

Two workers stick ceramic tiles and record number of tiles they stuck, the opposite graph shows the total number of tiles that each worker has stuck and the elapsed time in minutes.



From the graph, answer the following questions :

- What rule describes the number of stuck tiles by the 1<sup>st</sup> worker compared to the elapsed time ? then create a data table describe that.
- What rule describes the number of stuck tiles by the 2<sup>nd</sup> worker compared to the elapsed time? then create a data table describe that.
- What is the total number of stuck tiles after 10 minutes where the two workers work together ?

#### Solution

##### a. The rule :

The number of stuck tiles by the 1<sup>st</sup> worker  
 $= 3 \times$  elapsed time in minutes.

##### • The data table :

Elapsed time in minutes	Number of stuck tiles by the 1 <sup>st</sup> worker
1	3
2	6
3	9
4	12
5	15
6	18

##### c. After 10 minutes :

- The first worker has stuck :  $3 \times 10 = 30$  tiles
- The second worker has stuck :  $2 \times 10 = 20$  tiles
- The two workers together have stuck  $= 30 + 20 = 50$  tiles

##### b. The rule :

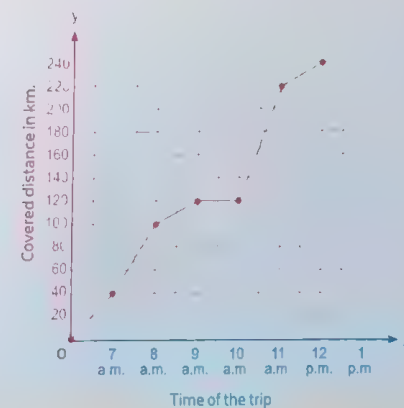
The number of stuck tiles by the 2<sup>nd</sup> worker  
 $= 2 \times$  elapsed time in minutes.

##### • The data table :

Elapsed time in minutes	Number of stuck tiles by the 2 <sup>nd</sup> worker
1	2
2	4
3	6
4	8
5	10
6	12

#### Example 2

Islam travelled by his car from Cairo to Alexandria. He has left home at 6 a.m. He kept track of the number of kilometers he covered at the end of each hour and record it on the grid as the opposite :



From the graph, answer the following questions :

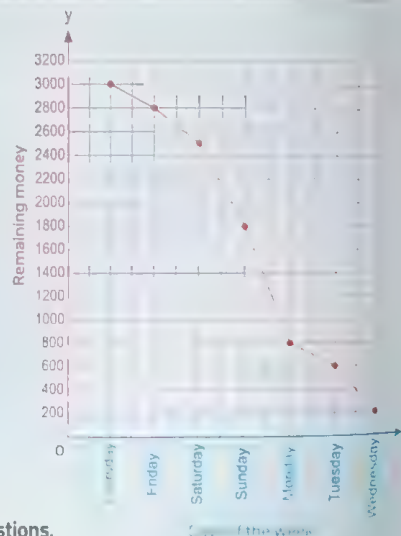
- What does the ordered pair (11, 220) tell us ?
- What does the horizontal line from 9 a.m. to 10 a.m. mean ?
- Between which two hours did Islam cover 60 km ?
- What is the covered distance till 11 a.m. ?
- During which hour did Islam drive fastest ? How do you know ?

### Solution

- (11, 220) means at 11 a.m. Islam covered a distance 220 km
- The horizontal line means Islam took a rest from 9 a.m. to 10 a.m.
- Between 7 a.m. and 8 a.m. Islam covered 60 km
- The covered distance till 11 a.m. equals 220 km
- Islam drove fastest between 10 a.m. and 11 a.m. because he travelled 100 km at this hour

### Check your understanding

On Thursday (the end of the work week), Shady took 3000 L.E. as a weekly salary, he spent from them each day and saved the remainder at the end of the week, the opposite graph shows how many pounds Shady had at the beginning of each day.



From the graph, answer the following questions.

- Why are the y values decreasing on the graph ?
- What does the ordered pair [Saturday, 2500] mean ?
- At which day did Shady spend most money ?
- How many pounds did Shady have at the beginning of Monday ?

## Exercise 20

on lessons 10&11

REMEMBER UNDERSTAND APPLY PROBLEM SOLVING

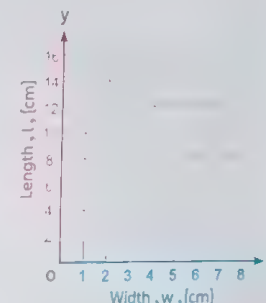
From the school book

### Graphing Real-World Data Interpreting Real-World Graphs

- The length of a rectangle is twice its width, in centimeters. This information can be represented by the rule, Length ( $l$ ) =  $2 \times$  width ( $w$ ).

a. Use the pattern to complete the table.

Width, $w$ [cm]	1	2	A	5	C	8
Length, $l = 2w$ [cm]	2	4	8	B	12	D



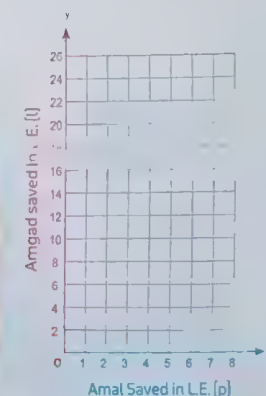
- Using the width data as x-coordinates and the length data as y-coordinates, plot the data on the coordinate grid. Then, draw a line the connect the points.
- The width of the rectangle is 3 centimeters.  
The length is \_\_\_\_\_ cm.
- The width of the rectangle is 5.5 centimeters. The length is \_\_\_\_\_ cm.
- The length of the rectangle is 6 centimeters. The width is \_\_\_\_\_ cm.
- The length of the rectangle is 14 centimeters. The width is \_\_\_\_\_ cm.

- Amgad saves daily an amount of pound three times the amount his sister Amal saves.

- Write a rule represents these information.
- Complete the following table.

Amal saved in L.E. (p)	1	2	—	4	—	8
Amgad saved in L.E. (l)	3	6	9	—	18	—

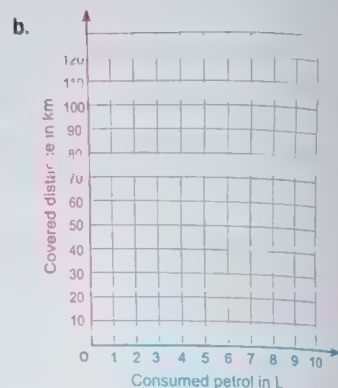
- Using Amal saved money data as x-coordinates and Amgad saved data as y-coordinates, plot data on the coordinate grid then draw a line to connect the points.



3. A car consumes one litre of petrol to cover a distance 10 km, complete the following table and then graph the points on the grid.

a.

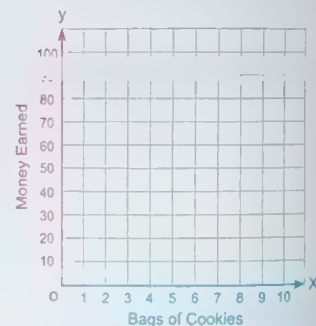
Consumed petrol in litre	Covered distance in km
1	_____
3	_____
4	_____
_____	60
_____	80
9	_____



- c. How many litre of petrol are needed to cover 120 km ?

4. Ola is selling bags of cookies in her neighborhood to make extra money to buy a new bike. She earns 5 L.E. for each bag of cookies she sells. Complete the table and then graph the points on the coordinate grid.

Bages of Cookies	Money Earned L.E.
2	_____
4	_____
7	_____
8	_____
10	_____



5. Nabil and Osman are in a 5-hour bike race. Nabil is traveling at a rate of 30 kilometers per hour. Osman is traveling at a rate of 60 km/hr use the information to complete the tables.

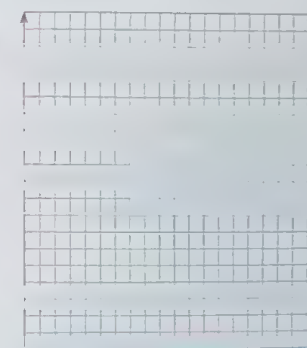
a.

Nabil (30 km/hr)	
Number of Hours	Total Distance (km)
1	_____
2	_____
3	_____
4	_____
5	_____

b.

Osman (60 km/hr)	
Number of Hours	Total Distance (km)
1	_____
2	_____
3	_____
4	_____
5	_____

- c. Graph the data from your table on the coordinate plane. Use a different color to represent each biker's data. Remember to label the x-axis and the y-axis and determine the scale for each axis.



- d. At the end of the race, who traveled farther ?
- e. How much farther did he travel ?
- f. The boys biked 120 kilometers at different times. How long did it take each of them ?

6. In the gym, Usama and Maged are playing the game cord where Usama jumps 30 jumps each minute and Maged jumps 40 jumps each minute , use that information to complete the following tables.

a.

Usama (30 jumps/min)	
Time in minutes	Total number of jumps
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____

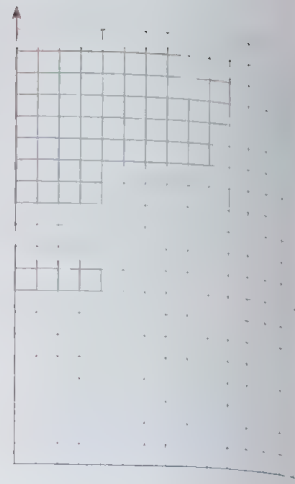
b.

Maged (40 jumps/min)	
Time in minutes	Total number of jumps
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____

- c. Graph the data from your table on the coordinate plane. Use different color to represent each player data. Remember to label the x-axis and y-axis and determine the scale for each axis.

- d. After 5 minutes from starting jumping, who jump farther?

- e. The two players jumped 120 jumps at different times, what are them?

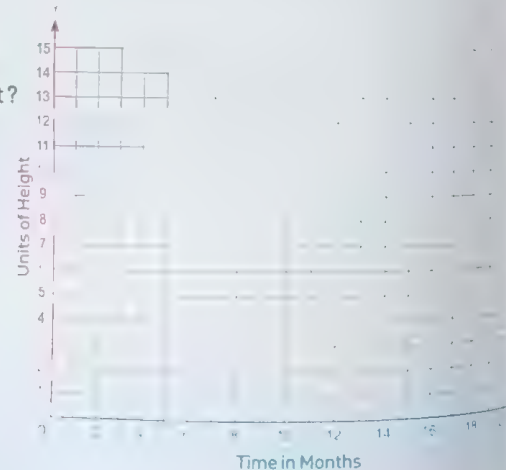


7. The table shows meerkat growth in the Kalahari of South Africa during their first 20 months of life. Graph the data on a coordinate plane and then connect the points with line segments.

Time in Months	0	2	4	6	8	10	12	14	16	18	20
Units of Height	3	5	6	7	8	9	10	12	12	12	12

Meerkat Height in Units Over First 20 Months

- a. What does the point (0 months, 3 units) mean for a typical meerkat's height?
- b. How tall do you think a typical meerkat gets? Why do you think so?
- c. At what age do meerkats reach their full height? How do you know from this graph?

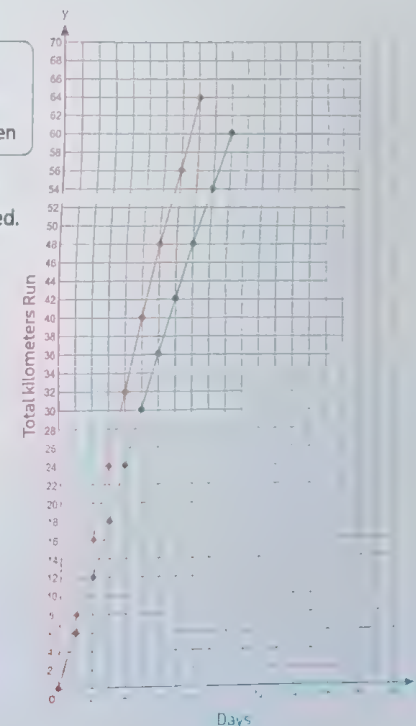
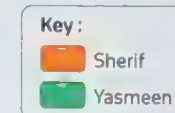


8. Developers in cities need permits to construct buildings. A developer in downtown Cairo is trying to decide whether he should build an office building with 8 offices per floor or 12 offices per floor. How could the developer use the table and a coordinate plane to help him analyze data and make decisions about the height of the building he will construct? Use words and numbers to support your thinking.

Number of floors	8 offices per floor	12 offices per floor
0		
1		
2		
3		
4		

9. Yasmeen and Sherif record the kilometers they run. The graph shows the total distance that each person has run.

- a. What rule describes Yasmeen's total kilometers compared to the total days she has run? You may create a data table to help you, if needed.
- b. What rule describes Sherif's total kilometers compared to the total days he has run? You may create a data table to help you, if needed.



10. Nancy and Bassma record number of English words they save daily, the following graph shows the total number of English words that each person has saved.

a. What rule describes Nancy

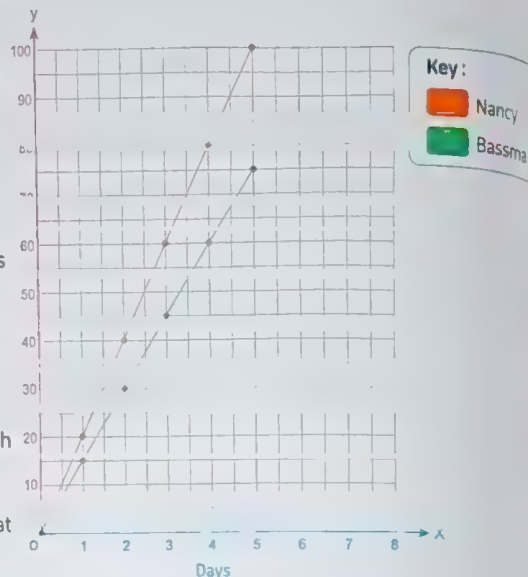
total saved words  
compared to the number  
of days? from it create  
a data table.

b. What rule describes

Bassma total saved words  
compared to the number  
of days? from it create  
a data table.

c. After how many days, each  
of them save the same  
number of words and what  
is this number?

d. At the fourth day what is the difference between Nancy saved words and Bassma saved words?



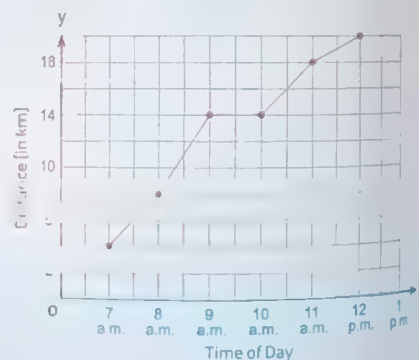
11. Ehab left his home at 6 a.m. to go on a bike ride. He kept track of the number of kilometers he biked at the end of each hour and recorded it on the grid. Use the coordinate grid to solve the problems.

a. What does the ordered pair (9, 14) tell us?

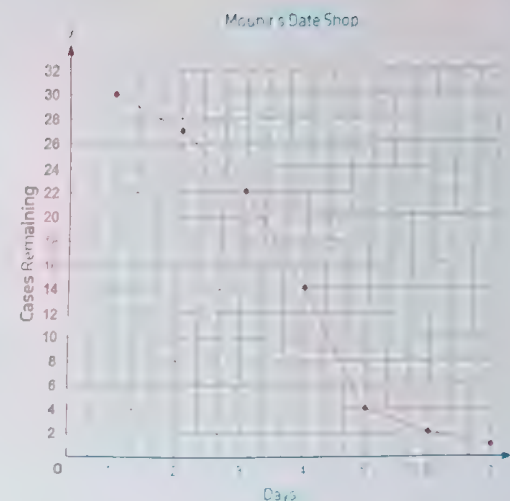
b. Did Ehab ride more kilometers before or after his break? Explain.

c. Between which two hours did Ehab ride 4 kilometers?

d. During which hour did Ehab ride the fastest? How do you know?

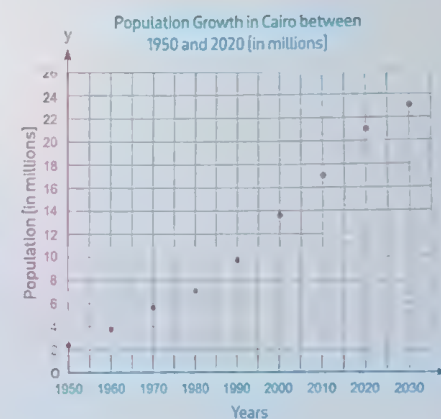


12. Mounir sells dates at a local market. Each case contains one dozen dates. On Day 1, he had 30 cases to sell. This graph shows how many cases he had at the beginning of each day. Use the coordinate grid to answer the questions.



- a. Why are the y values decreasing on the graph?  
b. What does the ordered pair (2, 27) mean?  
c. On which day did Mounir sell the most dates? How do you know?  
d. How many dates did Mounir have left to sell on Day 7?  
e. How many individual dates has Mounir sold from Days 1 Through 7?  
f. Why do you think the line drops so sharply from Days 3 to 5?

13. This coordinate grid shows the approximate population of Cairo between 1950 and 2020 and the city's predicted population in 2030. Reflect on the data on the grid. Then, answer the question. How might city planners use this data to inform the work they do to improve transportation, housing, and access to goods and services?



## Unit Ten Assessment



### 1. Choose the correct answer.

- a. The triangle whose side lengths are \_\_\_\_\_ is an isosceles triangle.  
 A. 7 cm, 7 cm, 7 cm                      B. 5 cm, 7 cm, 5 cm  
 C. 4 cm, 5 cm, 3 cm                      D. 8 cm, 6 cm, 9 cm
- b. The area of rectangle of length  $\frac{3}{4}$  cm and width  $\frac{2}{5}$  cm is \_\_\_\_\_  $\text{cm}^2$   
 A.  $\frac{1}{4}$                       B.  $\frac{5}{9}$                       C.  $\frac{3}{10}$                       D.  $\frac{2}{3}$
- c. The X-coordinate in ordered pair (3, 2) is  
 A. 3                      B. 2                      C. 5                      D. 6
- d. The value of the missing numbers in the following table is

x values	2	3	4	5	6
y values	2	4	6	—	—

- A. 7, 9                      B. 8, 10                      C. 6, 8                      D. 10, 12
- e. The polygon which has only one pair of parallel sides is called —  
 A. trapezium                      B. parallelogram                      C. rhombus                      D. square
- f. The opposite triangle is  
 A. acute                      B. right  
 C. obtuse                      D. equilateral
- g. The measure of any angle of the square = \_\_\_\_\_°  
 A. 60                      B. 90                      C. 100                      D. 180

### 2. Complete.

- a. The four sides are equal in length in \_\_\_\_\_ and \_\_\_\_\_
- b. The triangle XYZ is an equilateral triangle whose perimeter is 18 cm, then XY = \_\_\_\_\_ cm
- c. In the opposite number line :  
 The value of D is \_\_\_\_\_



## Unit Ten Assessment

### d. In the opposite figure :

- The ordered pairs that represent the point A is
- e. Each two opposite sides are parallel in \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_
- f. The triangle opposite is \_\_\_\_\_-angled triangle.
- g. The point (0, 7) lies on \_\_\_\_\_-axis.
- h. In any triangle, there are two \_\_\_\_\_ angles at least.



### 3. Choose the correct answer.

- a. If the area of rectangle is 2 square meters and one of its dimensions is  $\frac{1}{2}$  m, then the other dimension is  
 A. 1 m                      B. 2 m                      C.  $2\frac{1}{2}$  m                      D. 4 m
- b. ABC is an equilateral triangle. If two side lengths of it are 6.5 cm and 6.5 cm, then the third side is \_\_\_\_\_ cm.  
 A. 13                      B. 2.25                      C. 6.5                      D. 7
- c. The hexagon has \_\_\_\_\_ sides.  
 A. 4                      B. 5                      C. 6                      D. 7
- d. The y-coordinate in the ordered pair (6.5, 6.2) is  
 A. 6.5                      B. 6.2                      C. 12.7                      D. 0.3
- e. The area of a square of side length 2.5 cm is \_\_\_\_\_  $\text{cm}^2$   
 A. 6.25                      B. 5                      C. 10                      D. 0.5
- f. The subcategories of square and rhombus is \_\_\_\_\_  
 A. 4 right angles                      B. 4 equal sides  
 C. 2 acute angles                      D. 2 obtuse angles
- g. Which of the following points located on x-axis?  
 A. (4, 0)                      B. (0, 4)                      C. (4, 5)                      D. (5, 4)

#### 4. Answer the following.

- Ahmed owns a parking lot. The lot is 4 kilometers long and  $3\frac{1}{2}$  km wide. What is the area of the parking lot?
- Ahmed is making a design using a quadrilateral of 4 right angles. Write its name.
- Yehia and Paula are in a 5-hour bike race. Yehia is travelling at a rate of 40 kilometers per hour. Paula is travelling at a rate of 50 km/hr.

(1) Use that information to complete the tables.

Yehia (40 km/hr)		Paula (50 km/hr)	
Number of Hours	Total Distance (km)	Number of Hours	Total Distance (km)
1		1	
2		2	
3		3	
4		4	
5		5	

- (2) Graph the data from your table on the coordinate plane. Use a different color to represent each biker's data. Remember to label the x-axis and the y-axis and determine the scale for each axis.



## Theme 4 | Applications of Geometry and Measurement

# 11 Volume

» Concept 1 : Understanding Volume and Capacity

» Concept 2 : Measuring Volume

**Did You Know?!**

The United Nations Building is a famous building in New York. It is in the shape of **cuboid**.



## Concept

# 1

# Understanding Volume and Capacity

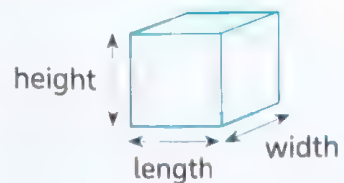


Lesson No.	Lesson Name	Learning Objectives
Lessons 1&2	Multiple Dimensions	<ul style="list-style-type: none"><li>• Students will name three-dimensional figures.</li><li>• Students will identify attributes of three-dimensional figures.</li><li>• Students will define volume and capacity</li></ul>
	Measuring a New Dimension	<ul style="list-style-type: none"><li>• Students will explain why volume and capacity are attributes of three-dimensional figures.</li><li>• Students will relate the dimensions of solid figures to measuring volume.</li><li>• Students will use cubic units to describe the volume of models and drawings.</li></ul>
Lessons 3&4	Estimating and Measuring Volume	<ul style="list-style-type: none"><li>• Students will estimate the volume of rectangular prisms in unit cubes.</li><li>• Students will use unit cubes to measure the volume of rectangular prisms.</li></ul>
	Same Volume, Different Shape	<ul style="list-style-type: none"><li>• Students will use unit cubes and models to create right rectangular prisms with a given volume.</li></ul>

- Multiple Dimensions
- Measuring a New Dimension

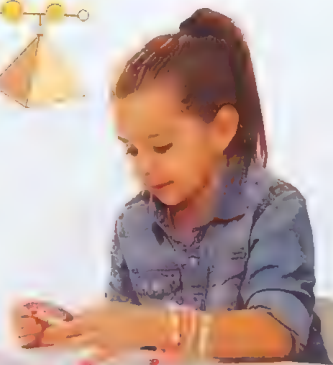
### Learn 1 Three-dimensional figures

- Solid figures have length, width, and height. They are also called **three-dimensional figures**.



#### Problem

Jodie's grandmother gave her a charm bracelet and asked her to name each charm on her bracelet.



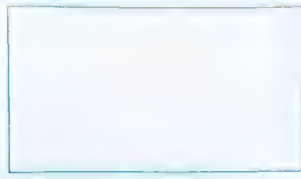
Answer :

Rectangular prism [Cuboid]		Cube	
Sphere		Cone	
Cylinder		Square pyramid	

### Two-dimensional shapes



Square



Rectangle

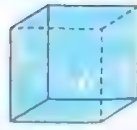


Triangle

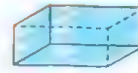


Circle

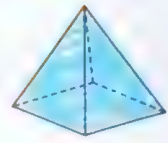
### Three-dimensional figures



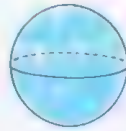
Cube



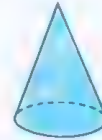
Rectangular Prism  
[cuboid]



Pyramid



Sphere



Cone



Cylinder

### ✓ Check your understanding

Name the solid figure that each object looks like

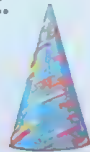
a.



b.



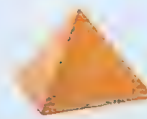
c.



d.



e.



f.



### How to describe the three-dimensional figure ?

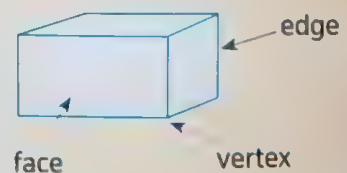
You can describe the three-dimensional figure using some vocabulary "face - edge - vertex"

A **face** is a flat surface of a solid figure.

An **edge** is the line segment formed where two faces meet.

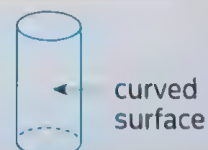
A **vertex** is a point where three or more edges meet.

The plural of vertex is vertices.

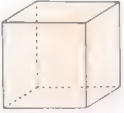
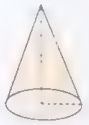


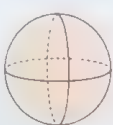
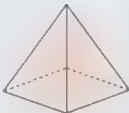


### Notice

Some three-dimensional figures have curved surfaces.



## Attributes of Three-Dimensional Shapes

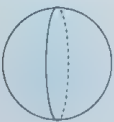
	Name	Picture	Face/Base Shape[s]	Number of Faces/Bases	Number of Edges	Number of Vertices
1	Cube		Square	6	12	8
2	Cone		Circle	1	0	1
3	Cylinder		Circle	2	0	0
4	Rectangular Prism [Cuboid]		Rectangle and square	6	12	8
5	Sphere		No face	0	0	0
6	Square Pyramid		Triangle and square	5	8	5

**Check**

your understanding

Write how many faces, edges and vertices are there.

a. Sphere



• \_\_\_\_\_ vertices.

• \_\_\_\_\_ flat faces.

• \_\_\_\_\_ edges.

b. Square-based pyramid



• \_\_\_\_\_ vertices.

• \_\_\_\_\_ flat faces.

• \_\_\_\_\_ edges.

c. Cube



• \_\_\_\_\_ vertices.

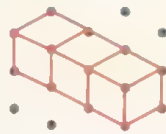
• \_\_\_\_\_ flat faces.

• \_\_\_\_\_ edges.

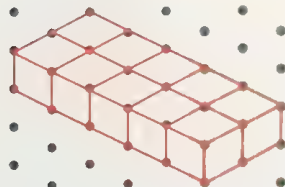
## Learn 2 Drawing three-dimensional designs with dots



Unit cube



Three cube units



\* 1 cube high  
\* 5 cube long  
\* 2 cube wide  
\* volume = 10 cubes



\* 5 cubes high  
\* 2 cubes long  
\* 1 cube wide  
\* volume = 10 cubes



**check** your understanding

Draw a design of volume.

a. 3 cube units

b. 6 cube units

c. 12 cube units



# Exercise 21

on lessons 1&2

- Multiple Dimensions
- Measuring a New Dimension

REMEMBER

UNDERSTAND

APPLY

PROBLEM SOLVING

From the school book

1. Name the solid figure that each object is shaped like.

a.



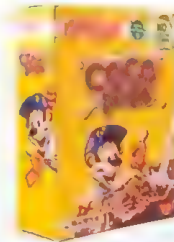
b.



c.



d.

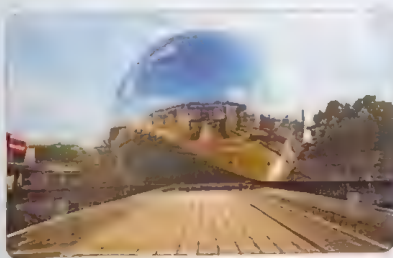


e.



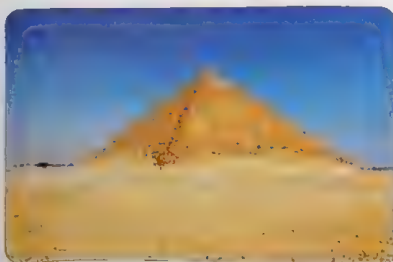
2. Look at the images of buildings around the world, then choose the name of each building's shape to the building.

a. La Géode-Paris



- A. Cube
- B. Cone
- C. Cylinder
- D. Sphere
- E. Rectangular prism
- F. Square pyramid

b. Dashur Pyramids-Egypt



- A. Cube
- B. Cone
- C. Cylinder
- D. Sphere
- E. Rectangular prism
- F. Square pyramid

c. El Gezira tower (also known as Borg El Qahera)-Egypt



- A. Cube
- B. Cone
- C. Cylinder
- D. Sphere
- E. Rectangular prism
- F. Square pyramid

d. Modern Building-Australia



- A. Cube
- B. Cone
- C. Cylinder
- D. Sphere
- E. Rectangular prism
- F. Square pyramid

e. The Red Chapel of Hatshepsut-Egypt



- A. Cube
- B. Cone
- C. Cylinder
- D. Sphere
- E. Rectangular prism
- F. Square pyramid

f. Stuttgart City Library-Germany



- A. Cube
- B. Cone
- C. Cylinder
- D. Sphere
- E. Rectangular prism
- F. Square pyramid

g. The Ministry of Foreign Affairs-Egypt



- A. Cube
- B. Cone
- C. Cylinder
- D. Sphere
- E. Rectangular prism
- F. Square pyramid

3. Name the solid figure. Then tell the number of faces, edges, and vertices.

a.



Name : \_\_\_\_\_

\* \_\_\_\_\_ faces.

\* \_\_\_\_\_ edges.

\* \_\_\_\_\_ vertices.

b.



Name : \_\_\_\_\_

\* \_\_\_\_\_ faces.

\* \_\_\_\_\_ edges.

\* \_\_\_\_\_ vertices.

c.



Name : \_\_\_\_\_

\* \_\_\_\_\_ faces.

\* \_\_\_\_\_ edges.

\* \_\_\_\_\_ vertices.

d.



Name : \_\_\_\_\_

\* \_\_\_\_\_ flat faces.

\* \_\_\_\_\_ edges.

\* \_\_\_\_\_ vertices.

e.



Name : \_\_\_\_\_

\* \_\_\_\_\_ flat faces.

\* \_\_\_\_\_ edges.

\* \_\_\_\_\_ vertices.

f.



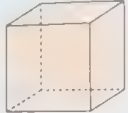


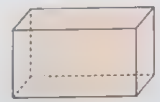
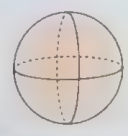

Name : \_\_\_\_\_

\* \_\_\_\_\_ flat faces.

\* \_\_\_\_\_ edges.

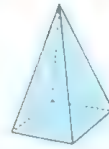
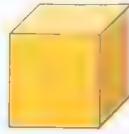
\* \_\_\_\_\_ vertices.

4. Complete to fill in the table.

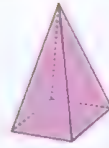
Attributes of Three-Dimensional Shapes						
	Name	Picture	Face/Base Shape[s]	Number of Faces/Bases	Number of Edges	Number of Vertices
a.	Cube					
b.	Cone					
c.	Cylinder					
d.	Rectangular Prism [Cuboid]					
e.	Sphere					
f.	Square Pyramid					

5. Circle the solid figures that match the given data.

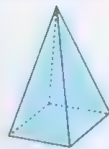
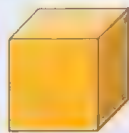
a. Shapes with 6 or more edges.



b. Shapes with 5 vertices.



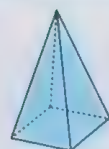
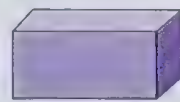
c. Shapes with at least 1 circle face.



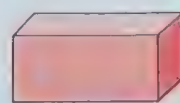
d. Shapes with more than 2 faces but fewer than 6.



e. Shapes with 0 edges, 0 faces and 0 vertices.



f. Shapes with more than 5 vertices.



## 6. Who am I?

- a. I have no edges, no flat faces and no vertices. [ ]
- b. I have 6 squared faces, 12 edges and 8 vertices. [ ]
- c. I have squared base, 5 faces, 8 edges and 5 vertices. [ ]
- d. I have 2 circular bases, no edges and no vertices. [ ]
- e. I have one circular base, one vertex and no edges. [ ]

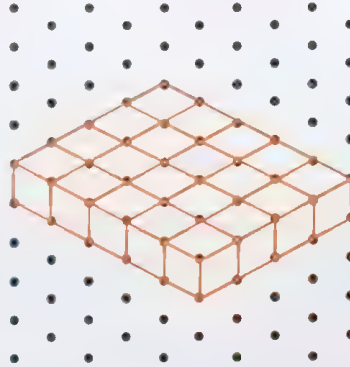
## 7. Complete.

a.



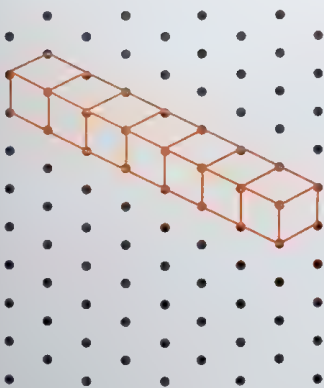
- \* — cube high.
- \* — cube long.
- \* — cube wide.
- \* Volume = — cubes.

b.



- \* — cube high.
- \* — cube long.
- \* — cube wide.
- \* Volume = — cubes.

c.

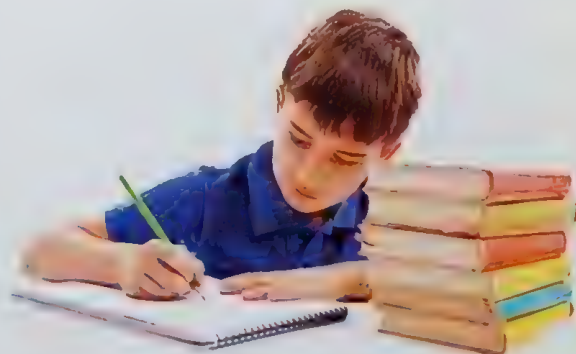


- \* — cube high.
- \* — cube long.
- \* — cube wide.
- \* Volume = — cubes.

d.



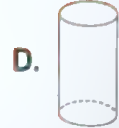
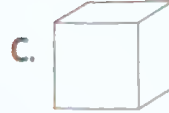
- \* — cube high.
- \* — cube long.
- \* — cube wide.
- \* Volume = — cubes.



## Multiple Choice Questions

Choose the correct answer.

1. Which of the following is a cube ?



2. Which of the following has 8 vertices ?

A. Sphere

B. Rectangular prism

C. Square-based pyramid

D. Cone

3. In which of the following you can find  ?

A. Cube

B. Sphere

C. Rectangular prism

D. Cylinder

4. The solid which has 12 edges, 8 vertices and 6 rectangle faces is

A. cube

B. cuboid

C. square base pyramid

D. cylinder

5. has



A. 4

B. 8

C. 10

D. 2

6. Volume of volume of

A. >

B. <

C. =

7. The cuboid has \_\_\_\_\_ edges.

A. 14

B. 8

C. 20

D. 12

8. The pieces of cards can form

A. cuboid

B. cube

C. pyramid

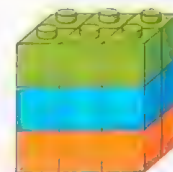
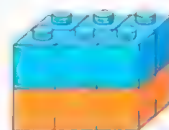
D. cylinder

# Lessons 3 & 4

- Estimating and Measuring Volume
- Same Volume, Different Shape

## Learn 1 Form cube / cuboid and find its volume

Use blocks game to form solids, then count the used block pieces to find the volume.

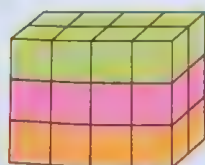


Number of horizontal layer	1	2	3
Number of cubes in each horizontal layer	6	6	6
Volume	$1 \times 6 = 6$ cube units	$2 \times 6 = 12$ cube units	$3 \times 6 = 18$ cube units

## ✓ Check your understanding

Complete.

a.



- Number of horizontal layer = \_\_\_\_\_
- Number of cubes in each horizontal layer = \_\_\_\_\_ cubes.
- Volume = \_\_\_\_\_  $\times$  \_\_\_\_\_  
= \_\_\_\_\_ cube units

b.

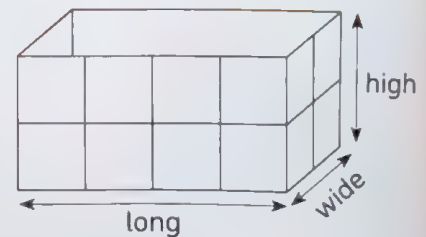
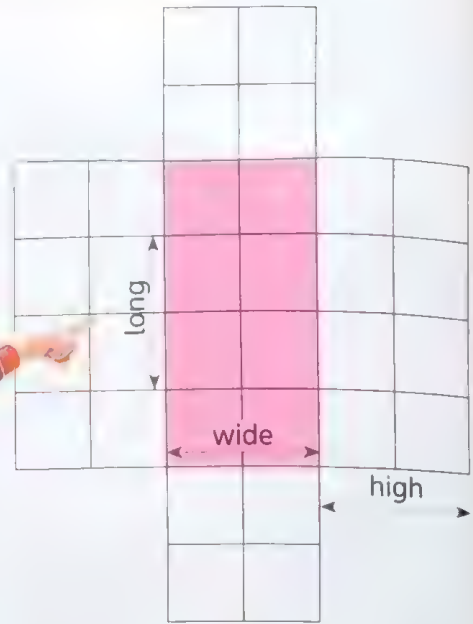


- Number of vertical slices = \_\_\_\_\_
- Number of cubes in each vertical slices = \_\_\_\_\_
- Volume = \_\_\_\_\_  $\times$  \_\_\_\_\_  
= \_\_\_\_\_ cube units

## Learn 2 Using net square to form a cube / cuboid

If you cut the opposite net square of 1 cm unit and fold the shape so that the coloured part as the base of the formed solid, then tape the terminals together to form a cuboid whose :

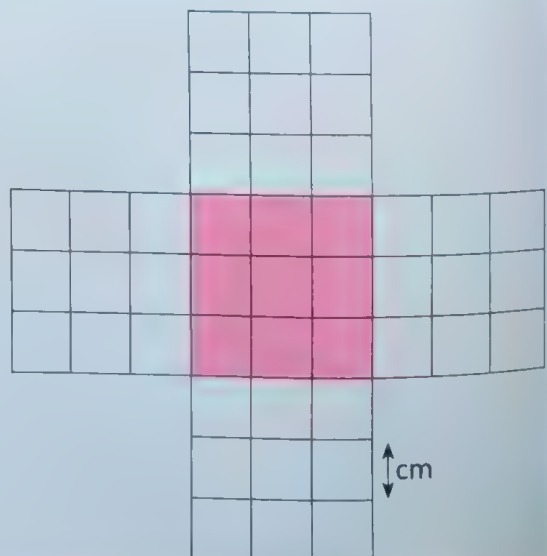
- Long = 4 cm
- Wide = 2 cm
- High = 2 cm
- Number of layer = 2
- Number of cubic centimeter [ $\text{cm}^3$ ] in each layer = 8
- Volume =  $2 \times 8 = 16 \text{ cm}^3$



### Check your understanding

If you cut and fold the opposite net square, then complete.

- Name of the resulted solid \_\_\_\_\_
- Volume of the resulted solid \_\_\_\_\_



## Volume / Capacity

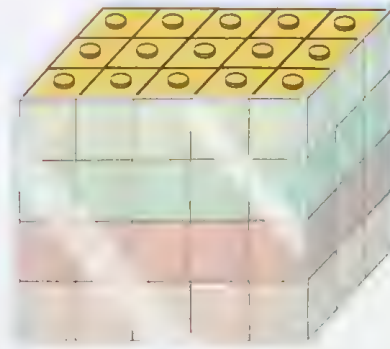
### Volume

Is how much space a three-dimensional figure takes up.

### Capacity

Is the amount a three-dimensional figure can hold.

### • How could you measure the capacity of a box as a cuboid ?

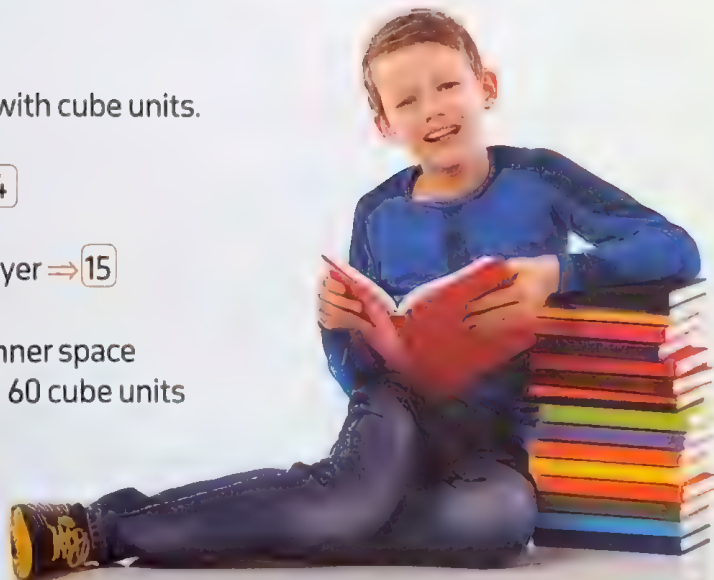


1 Fill up the inner space of the box with cube units.

2 Count number of cubes layer  $\Rightarrow 4$

3 Count number of cubes in each layer  $\Rightarrow 15$

4 Capacity of the box = volume of inner space  
 $= 4 \times 15 = 60$  cube units



## Exercise 22

on lessons 3&4

- Estimating and Measuring Volume
- Same Volume, Different Shape

REMEMBER

UNDERSTAND

APPLY

PROBLEM SOLVING

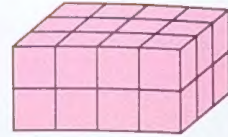
From the school book

1. Complete, where the unit cube is  $1 \text{ cm}^3$

a. 1. Number of horizontal layers : \_\_\_\_\_

2. Number of cubes in each horizontal layer : \_\_\_\_\_

3. Volume = \_\_\_\_\_  $\times$  \_\_\_\_\_ = \_\_\_\_\_  $\text{cm}^3$



b. 1. Number of horizontal layers : \_\_\_\_\_

2. Number of cubes in each horizontal layer : \_\_\_\_\_

3. Volume = \_\_\_\_\_  $\times$  \_\_\_\_\_ = \_\_\_\_\_  $\text{cm}^3$



c. 1. Number of vertical slices : \_\_\_\_\_

2. Number of cubes in each vertical slice : \_\_\_\_\_

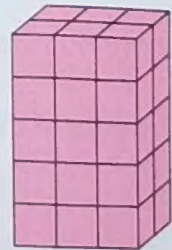
3. Volume = \_\_\_\_\_  $\times$  \_\_\_\_\_ = \_\_\_\_\_  $\text{cm}^3$



d. 1. Number of vertical slices : \_\_\_\_\_

2. Number of cubes in each vertical slice : \_\_\_\_\_

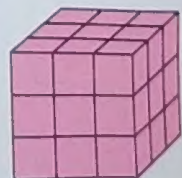
3. Volume = \_\_\_\_\_  $\times$  \_\_\_\_\_ = \_\_\_\_\_  $\text{cm}^3$




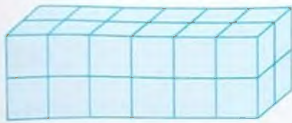
e. 1. Number of horizontal layers : \_\_\_\_\_

2. Number of cubes in each horizontal layer : \_\_\_\_\_

3. Volume = \_\_\_\_\_  $\times$  \_\_\_\_\_ = \_\_\_\_\_  $\text{cm}^3$



2.  **Using your centimeter cubes.** Decompose the shape into layers (horizontal) or slices (vertical) in three different ways. Then, draw your layers and slices in the given blank models.



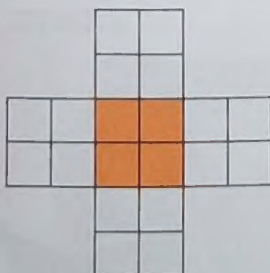
, then complete the table for the models you created.

Number of layers / slices	Cubes in each layers / slices	Volume of the prism

3.  **How many cubes ?**

- Copy the given figure into your grid paper. [The images on the page are smaller than they will be on your grid paper].
- Cut out the image.
- Fold the shape so the shaded section is the base of the shape.
- Tape the shape together to form a box.
- Estimate the volume of the shape.
- Use the centimeter cubes to measure the actual volume.

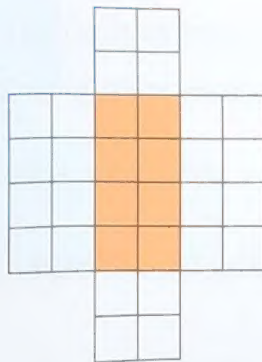
1.



**Estimated volume :** \_\_\_\_\_ cubic centimeters.

**Actual volume :** \_\_\_\_\_ cubic centimeters.

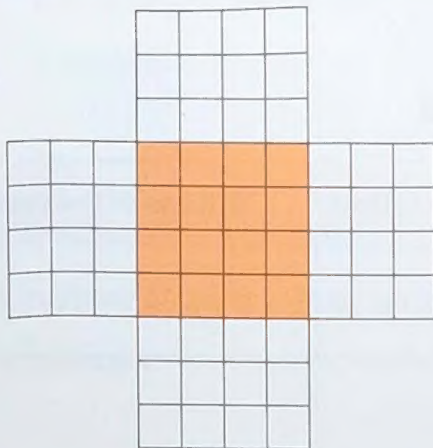
2.



Estimated volume : \_\_\_\_\_ cubic centimeters.

Actual volume : \_\_\_\_\_ cubic centimeters.

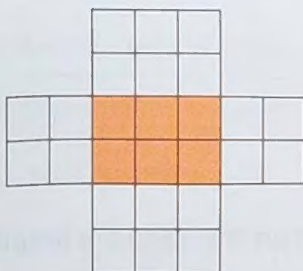
3.



Estimated volume : \_\_\_\_\_ cubic centimeters.

Actual volume : \_\_\_\_\_ cubic centimeters.

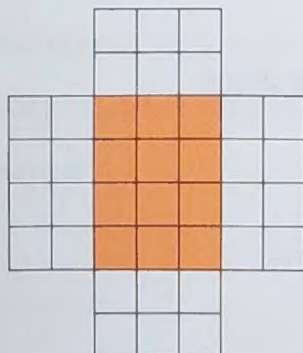
4.



Estimated volume : \_\_\_\_\_ cubic centimeters.

Actual volume : \_\_\_\_\_ cubic centimeters.

5.



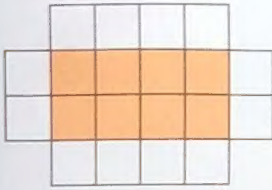
Estimated volume : \_\_\_\_\_ cubic centimeters.

Actual volume : \_\_\_\_\_ cubic centimeters.

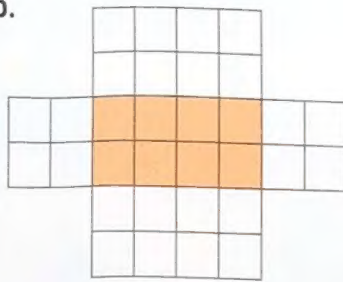


4. Match each net square to its suitable solid.

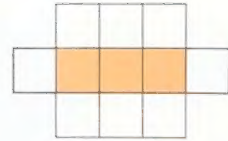
a.



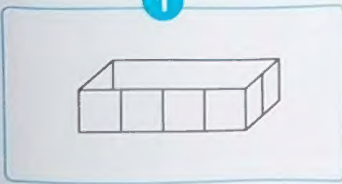
b.



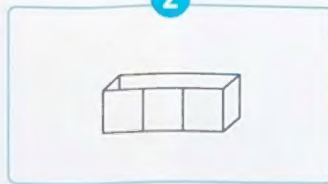
c.



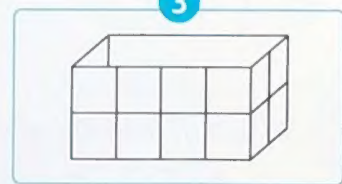
1



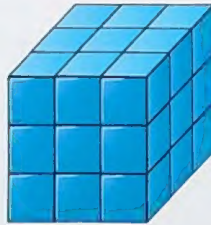
2



3



5. **Painting the cube.** Imagine you put blue paint on every side of the cube shown, including the base. Answer the questions.

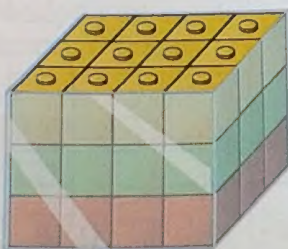


- How many of the small cubes have 3 blue faces?
- How many have 2 blue faces?
- How many have 1 blue face?
- How many have not been painted at all?



6. Find capacity.

a.



b.

